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TRANSACTIONS

OF THE

Fifteenth International Congress on Hygiene and Demography

WASHINGTON
September 23-28, 1912

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VOLUME IV

PROCEEDINGS OF SECTION V
Control of Infectious Diseases

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The proceedings of the Joint Session of Sections V and I and of the Joint Session of Sections V and VII are found in Volume I, Part II.

SECTION V.

CONTROL OF INFECTIOUS DISEASES.

REPORT OF THE SECRETARY.

Dr. Hermann M. Biggs, *President Section V*,
Fifteenth International Congress on Hygiene and Demography.

Sir: In accordance with the provision of Article XII of the regulations of the congress, I herewith submit a report of the proceedings of Section V, during the meeting held at Washington, September 23 to 28, 1912, together with such manuscripts of the papers read as have been delivered into my hands.

MONDAY, SEPTEMBER 23, 4 P. M.

The first session, held in the Pan American Union, was called to order by the president, Dr. Biggs, who announced the following honorary presidents of Section V:

Prof. Hans Hammerl (Austria), Prof. Wilhelm His (Germany), Dr. Eduardo Licéaga (Mexico), Dr. Vincente Llorente (Spain), Prof. Friedrich Loeffler (Germany), Prof. George H. F. Nuttall (England), Prof. Alfred Pettersson (Sweden), Dr. Simon von Unterberger (Russia), Dr. August Weber (Germany).

Immediately after organization the section was adjourned until the following morning.

TUESDAY, SEPTEMBER 24, 9.30 A. M.

Dr. Hermann M. Biggs presided during the morning session.

Papers were presented as follows:

The Relative Importance of Aerial and Contact Infection, by Dr. Charles V. Chapin, Superintendent of Health, Providence, R. I.

The Control of Disinfection and the Influence of Infected Rooms and Fomites, by Dr. Alvah H. Doty, New York City.

The Prevention of the Spreading of Contagious Diseases by Infected Habitations or Infected Clothes, by Prof. Dr. Hans Hammerl, University of Graz.

Demonstration of a Simple and Certain Method for Disinfecting Stools at the Bedside, by Prof. Dr. M. Prausnitz, University of Graz.

Prophylactic Importance of Disinfection in Urban and International Sanitary Administration, by Dr. Francisco Valenzuela, Chief of the Department of Disinfection, Mexico.

TUESDAY, SEPTEMBER 24, 2 P. M.

The afternoon session was called to order by the president, Dr. Hermann M. Biggs, who presided throughout the session.

The following papers were presented in the symposium on sanitary measures against cerebrospinal meningitis:

Results of the Serum Treatment of Epidemic Meningitis, by Dr. Simon Flexner, of the Rockefeller Institute for Medical Research, New York City.

Preventive Measures against Epidemic Meningitis, by Dr. A. Sophian, Kansas City, Mo.

Etiology of Cerebrospinal Meningitis, by Dr. Rouget, Professor of Hygiene at Val-de-Grâce, Paris, France.

The following members of the congress joined in the discussion:

Dr. W. Ed. Grant (Louisville, Ky.), Dr. Wm. H. Park (New York City).

Papers on the control of rabies were presented as follows:

The Control of Rabies, by Prof. Henry Albert, University of Iowa, Iowa City.

The Nature and Treatment of Rabies, by Dr. James Gordon Cumming, University of Michigan, Ann Arbor.

The following members of the congress joined in the discussion:

Dr. Edward Licéaga (Mexico), Dr. Julius Rosenstirn (San Francisco, Cal.), Dr. Henry Albert (Iowa City, Iowa).

How the Campaign against Yellow Fever has been carried on in the Mexican Republic, by Dr. Edward Licéaga, President of the Supreme Board of Health of Mexico.

Papers were presented in the symposium on the administration and control of venereal diseases as follows:

The Municipal Clinic of San Francisco, by Dr. Julius Rosenstirn, Chairman Advisory Commission, Municipal Clinic, San Francisco, Cal.

The Eradication of the Social Diseases in Large Cities, by Dr. Robert N. Willson, Philadelphia, Pa.

WEDNESDAY, SEPTEMBER 25, 9.15 A. M.

The third session was called to order by the president, Dr. Hermann M. Biggs, who presided throughout the session.

In the symposium on bacillus carriers the following papers were presented:

Ueber Typhus-Bacillenträger, by Prof. H. Conradi, Technische Hochschule in Dresden.

The Carrier Problem in Typhoid Fever, by Dr. J. C. G. Ledingham, Lister Institute, London, England.

The Problem of the Detection of the Typhoid Carrier from the Standpoint of a Large Municipal Hospital, by Dr. Charles Norris, Bellevue and Allied Hospitals, New York City.

Diphtheria Bacillus Carriers, by Drs. Wm. L. Moss, Clyde G. Guthrie, and Johanna Gelien, Johns Hopkins University.

Treatment of Diphtheria Carriers by Overriding with Staphylococcus aureus, by Dr. Mazyck P. Ravenel, Director State Hygienic Laboratory, Wisconsin University, Madison.

Vaccine Treatment of Carriers, by F. M. Meader, M. D., Syracuse Medical College, Syracuse, N. Y.

The following members of the congress joined in the discussion:

Prof. A. Schattenfroh (Vienna, Austria), Dr. Simon von Unterberger (St. Petersburg, Russia), Dr. Theodore Thomson (London, England), Dr. Charles J. Hastings (Toronto, Canada), Dr. Frank Warner (Columbus, Ohio), Dr. Charles F. Bolduan (New York City), Dr. W. J. Lumsden (Elizabeth, N. C.), Dr. John A. Ferrell (Raleigh, N. C.).

Papers in the symposium on insect carriers were presented as follows:

The Part played by Flies and other Insects in the Spread of Infectious Diseases in the Tropics, by Dr. Samuel T. Darling, Ancon, Canal Zone.

Mouches et autres Insectes Porteurs de Maladies infectieuses, by Félix Mesnil, Pasteur Institute, Paris, France.

The following members of the congress joined in the discussion:

Dr. L. O. Howard (Washington, D. C.), Prof. G. H. F. Nuttall (Cambridge, England).

Relation of Oysters to the Transmission of Infectious Diseases, by Dr. Herbert D. Pease, Lederle Laboratories, New York City .

This paper was discussed by Dr. George A. Soper (New York City).

THURSDAY, SEPTEMBER 26, 9.15 A. M.

Joint session with Section I. For program see the report of the secretary of Section I.

THURSDAY, SEPTEMBER 26, 2 P. M.

The session was called to order by the president, Dr. Hermann M. Biggs, who presided during the afternoon.

Papers in the symposium on artificial immunization were presented as follows:

Antityphoid Inoculation: Three Years' Experience with its Use in Training Schools for Nurses in Massachusetts, by Dr. Lesley H. Spooner, Boston, Mass.

Community Immunization against Typhoid Fever, by Dr. M. Goltman, Superintendent of Health, Memphis, Tenn.

Smallpox and Vaccination in Siam, by Dr. Paul G. Woolley, Cincinnati, Ohio.

Verbreitung von Darmtyphus und ähnlichen Krankheiten durch Dünnbier, by Prof. Alfred Pettersson, Stockholm, Sweden.

The following members of the congress joined in the discussion:

Dr. John W. Brannan (New York City), Dr. H. G. Dorman (Beirut, Syria), Dr. Wm. G. Schauffler (Lakewood, N. J.), Dr. Eugene R. Kelley (Seattle, Wash.), Dr. Leslie L. Lumsden (Washington, D. C.), Dr. Lesley H. Spooner (Boston, Mass.), Dr. Edward Licéaga (Mexico), Dr. Arnold C. Klebs (Switzerland), Dr. Paul G. Woolley (Cincinnati, Ohio), Dr. Charles F. Bolduan (New York City), Prof. Alfred Pettersson (Sweden).

FRIDAY, SEPTEMBER 27, 9.15 A. M.

A joint session of Sections V and VII. The session was called to order by Dr. Rupert Blue, the president of Section VII.

Papers in the symposium on the prevention of the spread of communicable diseases through traffic were presented as follows:

The Municipal and State Control of Plague in Japan, by Prof. S. Kitasato, Tokyo, Japan.

Die epidemiologischen Beobachtungen anlässlich der Pestseuche in der Süd-Mandschurei, by Dr. N. Murata, Port Arthur, Manchuria.

Organization of the Bacteriologic Services for Plague in Cuba, by Dr. Mario G. Lebredo, Health Department, Cuba.

The Relation between Traffic and the Spread of Bubonic Plague, by Dr. W. C. Rucker, United States Public Health Service.

The Prevention of the Spread of Cholera over Maritime Transportation Routes, by Dr. R. H. von Ezdorf, United States Public Health Service.

The Supervision of the Migration of Tuberculous Patients, by Dr. Wm. F. Snow, Secretary of the State Board of Health, California.

Eliminating Typhoid from Rural Communities, by Dr. Harold B. Wood, Health Officer, Rochester, Minn.

The Origin and Prevention of Typhoid Fever, by Dr. W. Fornet, Kaiser-Wilhelms Akademie, Berlin, Germany.

The Prevention of Water-borne Disease in Lake and River Traffic, by Dr. Allan J. McLaughlin, United States Public Health Service.

The following members of the congress joined in the discussion: Prof. Dr. Hermann Tjaden (Bremen, Germany), Dr. Francisco Valenzuela (Mexico), Dr. L. E. Cofer (Washington, D. C.), Dr. Allan McLaughlin (Washington, D. C.), Dr. Frederick Montizambert (Ottawa, Canada), Dr. Charles F. Bolduan (New York City), Dr. Leslie L. Lumsden (Washington, D. C.).

FRIDAY, SEPTEMBER 27, 2 P. M.

The session was called to order by the president, Dr. Hermann M. Biggs.

Papers in the symposia on the rôle of bovine tuberculosis and the administrative control of tuberculosis were presented as follows:

Die Bedeutung der Rindertuberkulose für die Entstehung der menschlichen Tuberkulose, by Prof. Dr. A. Weber, Kais. Gesundheitsamt, Berlin, Germany.

The Relation of Bovine Tuberculosis to Human Tuberculosis, by Prof. G. Sims Woodhead, University of Cambridge, England.

The Rôle of Bovine Tuberculosis in the Production of Human Tuberculosis, by Prof. Wm. H. Park, Director, Research Laboratory, Health Department, New York City.

Twelve Years' Experience of Compulsory Notification of Pulmonary Tuberculosis in South Australia, by Dr. W. Ramsay Smith, Chairman Board of Health, Adelaide.

Contrôle administratif de la Tuberculose pulmonaire, by Dr. Guerbet, School of Medicine, Rouen.

A Study of the Observation and Enforcement of a Standard Tuberculosis Registration Law, by Dr. Charles S. Prest, State Charities Aid Association, Waterford, N. Y.

Certain Important Features of the Control of Tuberculosis, by Dr. Bertram H. Waters, division of communicable diseases, Department of Health, New York City.

Die Rolle der lymphatischen Konstitution in den Infektionskrankheiten, by Dr. Simon von Unterberger, St. Petersburg, Russia.

The following members of the congress joined in the discussion: Prof. Dr. A. Weber (Berlin, Germany), Dr. E. C. Schroeder (Bethesda, Md)., Dr. Simon von Unterberger (St. Petersburg, Russia), Dr. M. P. Ravenel (Madison, Wis.), Dr. Wm. H. Park (New York City), Dr. Hermann M. Biggs (New York City).

Reports of discussions as given to the secretary will be found in the transactions of this section.

Respectfully,
Dr. Charles F. Bolduan,
New York City.

TUESDAY MORNING, SEPTEMBER 24, 1912.

THE RELATIVE IMPORTANCE OF AERIAL AND CONTACT INFECTION.

Dr. CHARLES V. CHAPIN, Superintendent of Health, Providence, R. I.

In this discussion, by "air infection" is meant the diffiusion of the virus through the air of a room or ward or through the outside air. It involves more than droplet infection, which is rarely operative beyond a metre, and has no reference to the air carriage of insect hosts.

Until very recently infection by air was believed to be the chief factor in the extension of contagious diseases. As so many cases develop without actual contact with other cases, it was naturally assumed that the air was the bearer of the infection. We now know that the existence of carriers and missed cases affords such ample opportunity for infection by contact that the theory of aerial infection is no longer required by a priori reasoning.

The bacteriological evidence concerning infection by air will be only incidentally referred to, and attention will be directed chiefly to the experimental and epidemiological evidence. It must be admitted, however, that the discoveries of bacteriology did much to develop among epidemiologists a critical attitude toward the theory of aerial infection and led to the adoption of more scientific methods in the epidemiological study of disease.

INFECTION BY OUTSIDE AIR.

Until within a comparatively few years it was believed that most of the infectious diseases were readily transmissible even through the outer air. It was thought that scarlet fever and diphtheria might be contracted from passing cases on the street, or that these diseases were wafted from house to house. The dust of the street was considered a source of tuberculosis. Smallpox was believed, and is now believed by many, to be carried by the air from hospitals even to the distance of a mile or more. During the pandemic of influenza, toward the end of the last century, it was alleged that the disease was air-borne from town to town, and even thus carried across the ocean. Malaria and yellow fever were considered classical examples of air-borne infection, and the air was supposed to be a factor of great importance in the dissemination of plague and typhoid fever and cholera. Let us note how scientific investigation has been steadily restricting the sphere of aerial infection.

It seems scarcely worth while to consider the transmission through the outer air of such diseases as typhoid fever, cholera, and the diarrheal diseases, and plague and scarlet fever and diphtheria, since, as will be seen, there is good evidence that they are not so transmitted even indoors. Nevertheless, it is not long since ground air and sewer air and air from decaying matter was believed to be the cause of cholera and typhoid fever, and even within the last few years French military writers and English and American army surgeons have attributed the spread of typhoid fever through camps and garrisons to the air carriage of the bacilli, either on dust or otherwise. No convincing evidence has, however, been presented, and it is to be feared that this theory was advanced as an easy explanation of an etiology which should have been worked out by a study of food, water, and fly infection, or, most of all, by contact infection with carriers and missed cases. The extension of scarlet fever and diphtheria from hospitals, and even from house to house, has been alleged, and some data have been presented in proof. But the occurrence of cases, or even an excess of cases, near a hospital is no proof of a causal relation. On the other hand, careful observations in Paris, Boston, Detroit, New York, in England, and in my own city show that for years large numbers of cases of scarlet fever and diphtheria may be cared for in a hospital without any extension to adjoining houses or even to nearby wards for other diseases.

As regards influenza, the careful observations of Parsons, in England, and of Schmid, in Switzerland, showed that in isolated communities, where alone conditions of communication could be known, influenza was almost invariably found to be introduced by an infected person. The short incubation, the great number of mild, missed, and ambulatory cases, not to mention true carriers, explain perfectly the rapid diffusion of the disease, and the short life of the bacillus renders its distant aerial diffusion entirely impossible.

While in former years much was heard about the spread of plague and of typhus fever by means of the atmosphere, more careful epidemiological studies, and particularly the demonstration of the small part played by the air in the extension of these diseases indoors, has gradually led to an abandonment of these views. Mediterranean fever, too, was formerly classed among the air-borne diseases, but the experimental work of Horrocks and the successful control of the disease by methods thereby indicated have demonstrated that this disease is not air-borne, either indoors or outdoors. Early bacteriological findings encouraged the idea that tuberculosis might be caused by the inhalation of street dust, but further bacteriological, as well as epidemiological, studies have shown that this must be a very minor factor, if operative at all.

Malaria, as its name implies, was from ancient times considered a typical air-borne disease, and much apparently unimpeachable evidence of this gradually accumulated. Equally strong evidence was found to show that yellow fever is an air-borne disease. We now know, by unimpeachable experimental demonstration and by successful control, that in a certain sense both these diseases are air borne, for the mosquitoes, which are the intermediate carriers of the contagium, are at times wafted for considerable distances by atmospheric currents. The brilliant experiments which demonstrated these facts also demonstrated that these diseases are never air borne, in the ordinary meaning of the term; that is, the free contagium does not float in the air, and this demonstration has led many of us to reconsider the alleged evidence on which so many of our common diseases were believed to be thus carried.

The whole trend of modern investigation, both bacteriological and epidemiological, has been to remove one disease after another from the list of those which were formerly believed to be commonly transmitted through the outer air. This should not, however, prejudice us in the other direction and prevent us from weighing carefully the evidence for each individual disease. At present there seems to be only one disease the free transmission of the contagium of which through the external air is believed in by many. That smallpox may under certain conditions be carried a mile or more from hospitals occupied by cases of that disease was believed to have been demonstrated by the investigation of the English Local Government Board some 30 years ago. This belief was so firmly intrenched that stringent regulations were made to prevent the location of smallpox hospitals near centers of population. I have in another place attempted to enumerate some of the reasons which have led many to question this theory and others to entirely discard it. In the limited space here available it is perhaps sufficient to say that while there is, as alleged, in some instances an excessive incidence of smallpox around hospitals, in many other instances, both in England and in the United States, such an excess does not occur, and that when such an excess occurs it is perhaps sometimes due to the poor character of the surrounding population and sometimes to imperfect hospital administration. A careful study of the source of the cases near the hospital, even in the classic example of the Fulham Hospital, shows that many, and in some instances almost all, of the cases alleged to be due to air-borne infection are in reality due to contact often with missed cases. It is also to be noted that some of the alleged claims in regard to the conditions, direction, and amount of aerial transmission are contradictory and not in accord with the facts.

INFECTION BY INDOOR AIR.

While it may be true, as is here alleged, that diseases are not transmitted by the air out of doors, they might, nevertheless, be quite commonly transmitted by the air indoors. Before considering internal diseases, it will be suggestive to recall that wound infection was at first believed to be due largely to aerial infection, and aseptic surgery was based on this theory; but it has now been demonstrated by experience that aerial infection, even with rather unclean surroundings, is a negligible factor. This fact, when we remember the great numbers and the ubiquity of pus-forming bacteria, should make us question the aerial transmission of diseases in which the location and comparatively small numbers of the germs renders them less likely to be air borne.

In many of the diseases which have been shown not to be air-borne out of doors, as malaria, yellow fever, the bubonic type of plague, and Mediterranean fever, the demonstration of their mode of transmission has been a demonstration that they are not air-borne, even indoors. In plague and Mediterranean fever this has also been demonstrated by most convincing animal experiments. Unfortunately for many common and important diseases, animal experiments are difficult or impossible, and experiments on human beings are rarely permissible; but the conditions of hospital isolation, and even, to some extent, of home isolation, approach those of an experiment, and much of our knowledge of the mode of transmission of contagious diseases is derived from such hospital experience.

Personally I was first led to question the importance of aerial infection by noting the infrequency with which scarlet fever and diphtheria extend from one family to another living in different apartments in the same building. In Providence there was formerly no hospitalization of these diseases, and even now there is little, as compared with English towns. In about 5,000 cases, where other families lived in the same dwelling with a family in which there was scarlet fever, it was noted that only about 7 per cent were subsequently invaded by the disease. The figures are substantially the same for diphtheria. Since I have been more carefully studying the date and mode of invasion of the additional families, about 3,000 of them in each of the diseases named, have come under observation. Among these it appears that between the time the disease is recognized and the termination of isolation only from 1 to 2 per cent of the additional families are secondarily invaded, and a further study of individual cases shows that such infection does not take place unless there is actual commingling of the two families. True, there is not the opportunity for aerial infection that there is between the rooms in the same apartment, but doors into passageways are often open occasionally a large part of the time, and if infection by air were as easy as is generally believed disease would frequently spread from family to family, as, indeed, it was formerly generally believed that it did.

Very little evidence is available as to the relative part played by infection by air and infection by contact within the family. Cameron, in his valuable report on return cases of scarlet fever and diphtheria in London, shows that, in many instances, after the return of the infecting case infection does not take place until actual contact occurs. It has occurred to me that the relative frequency with which servants and other adult members of an infected family are secondarily attacked ought to indicate to some degree the relative importance of aerial and contact infection. Of 210 maids (other than nurses) in families where there was diphtheria only 1 contracted the disease, and in this family everyone was attacked, and the maid had to assist in their care. Of 271 adult males in these same families, mostly parents, 5, or 1.84 per cent, contracted the disease, and of 673 adult females (not including nurses) 28, or 4.16 per cent contracted it. It has also occurred to me that the much greater susceptibility of children between 2 and 8 years is due to the greater intimate contact with one another at these ages, the apparent immunity of infants being due to much less frequent contact with other children. So, too, the reason why mothers are nearly three times as likely to contract disease from their children as are their fathers is because of the much more intimate contact.

It is in hospitals that the best opportunity is afforded for studying the transmission of disease. If cases of contagious disease are cared for in the same room or ward with susceptible persons and few or no cases develop, it suggests that infection through the air does not readily take place. Thus, typhoid fever, cholera, and dysentery, although they were formerly sometimes transmitted in hospitals from patient to patient by contact infection, under modern conditions of cleanliness and modes of handling excreta can be safely cared for in general wards. So, also, typhus fever has been shown by observations in Aberdeen, Liverpool, Mexico, and elsewhere not to spread in general hospital wards, provided the patient is thoroughly cleansed on admission. The bubonic type of plague can also be safely cared for in wards with other diseases.

For health officials the question of the relative importance of air infection and contact infection is a very pressing one, and for those living in Europe and North America the diseases which most interest us are such common ones as scarlet fever, diphtheria, measles, whooping cough, smallpox, chicken pox, and tuberculosis, and it is precisely concerning these diseases that there are at the present time differences of opinion.

Cross infection in hospitals for contagious diseases, and indeed the transmission of infection from patient to patient in any hospital for children, has always been one of the great difficulties of hospital management. Infection by air has until very recently been considered the chief factor in this transmission. About 20 years ago the management of some of the hospitals for children in Paris began to make serious attempts to limit this cross infection by separating the patients by partitions running part way between the floor and the ceiling, the object apparently being to limit droplet infection from bed to bed. At the same time the importance of contact infection by means of all kinds of hospital utensils, and particularly by the hands of physicians and nurses, began to be properly appreciated. With the better application of aseptic methods and the consequent reduction in cross infection less and less importance was attached to aerial infection, even by means of mouth spray, and instead of the tight partitions, in some wards only wire screens were used as a reminder to the attendants to take every precaution against contact infection. Wherever strict medical asepsis was carried out to prevent infection by contact a great decrease in cross infection always took place, and this improvement was apparently in no way dependent upon the degree of air isolation, if I may be permitted this term. As long ago as 1900 Prof. Grancher wrote that contagion is "objective," not "atmospheric," and showed that the only way to prevent cross infection in hospitals is to prevent contact infection. Even for measles he narrates experience which indicate that infection by air is of minor importance, if not a negligible factor. Moizard at about the same time published similar extensive experiences and conclusions. These observations in the Parisian hospitals attracted considerable attention, though not the attention they deserved, and various experiments to limit cross infection were tried in France and in England. Sometimes patients were isolated in rooms having no internal communication, opening only into the external air. In other hospitals the isolation rooms open into a common corridor. Sometimes the doors are kept shut, so as to secure as much air isolation as possible, and sometimes no effort is made to prevent the free movement of air from room to room. In other hospitals incomplete partitions only are used between the beds. In still others cases of different contagious diseases are cared for in an open ward, with perhaps the use of wire screens, a tape stretched around the bed, or a warning card to indicate to the nurse the need of avoiding contact infection by means of strict cleanliness while passing from case to case. A study of the results attained under these varying conditions has convinced many that success in avoiding the spread of disease depends not on the degree of air isolation, but upon the success in preventing contact infection by the careful carrying out of aseptic methods. Thus Thomson, in London, reports 16 cross infections among 1,290 patients cared for in cubicles without complete air separation and 15 infections among 660 patients in separate rooms. Caiger reports 14 infections among 704 patients in cubicles with partial partitions. At the time I visited the Pasteur Hospital in Paris there was free communication between the rooms and the corridors, yet the present superintendent writes me that cross infections have been reduced to considerably less than 1 per cent.

Practically all who have seriously studied the problems of cross infection in hospitals, even if they believe that certain diseases are at times transmitted through the medium of the air, are agreed as to the very much greater importance of contact infection. No amount of separation of patients, even in different and distant wards, will suffice to prevent the spread of disease if physicians or nurses pass from case to case without taking the same precautions that they would in passing from an infected to a clean surgical case. This is well illustrated by the experience of the Babies' Hospital in New York, where the study of a constant stream of gonococcus infections demonstrated that the contagium was invariably carried on hospital utensils, or more often on the hands of nurses, and could be entirely prevented by aseptic methods. The success of the Pasteur Hospital and of many of the English hospitals seems to be due to the training of a permanent staff of nurses. Overwork and worry have been shown by Goodall and others to be a fruitful source of trouble, for under such circumstances careless cleansing of hands leads to contact infection. The employment in the United States of many short-time pupil nurses and internes renders the prevention of cross infection extremely difficult.

The most convincing evidence of the small and negligible part played by air in the carriage of disease is furnished by the treatment of different contagious diseases in the same open ward with no attempt at air isolation. This has been done successfully in a number of places, as in Manchester, Plaistow, Mortlake, and Liverpool, in England, and at Providence and Rochester, in the United States. Except for Liverpool, no exact figures seem to have been published, but Gordon and Arnold, at Manchester, and Biernacki, at Plaistow, report the treatment of all the common infectious diseases with very few cross infections. Although the number of cases is not given, the belief is expressed that the facts warrant this method, except, perhaps, for measles and chicken pox. Indeed, the experience with cubicles and rooms, as well as with open wards, has convinced almost all that diphtheria, whooping cough, rubella, and mumps are not air-borne when under hospital conditions, and that scarlet fever is rarely, if ever. Many think that measles and chicken pox may be air-borne. It seems certain that cross infection more readily takes place in these two diseases than in the others just mentioned. It may, however, be merely because, for some unknown reason, they are more readily carried on hands and things than are other diseases. Certain it is that when strict cleanliness is practiced, even if air infection is neglected, cross infections are rare in even these diseases. Hospital infection occasionally occurs in typhoid fever and very often in gonococcus infections, yet no one attributes this to air infection, but always to some failure in technique by which contact infection is permitted. So most of those who have studied hospital infection in other diseases believe that when it occurs it is usually, if not always, the result of infection by contact.

One of the most noteworthy attempts at the treatment of different diseases in the same ward has recently been reported from Liverpool by Rundle and Burton. No attempt whatever was made to secure air isolation, and all varieties of disease were admitted indiscriminately. In all, 668 persons passed through the ward, of whom 69 had scarlet fever, 40 diphtheria, 37 measles, 38 varicella, 9 whooping cough, and 215 erysipelas. There were only 2 cross infections—1 of diphtheria and 1 of scarlet fever. These authors believe that in hospital wards the " danger of aerial infection is to be disregarded for practical purposes."

In the hospital in Providence a large number of cases of contagious disease are cared for in rooms opening into a common corridor, no attempt being made to prevent the free movement of air, and a considerable number are cared for in open wards with other diseases. Among the latter, only one instance of cross infection has occurred, and this was in a child who managed to elude the nurse and come in direct contact with a case of scarlet fever. In the rooms on the corridor there have been two or three outbreaks, but the conditions were such that the superintendent, Dr. Richardson, believed that the infection was carried by the physicians or nurses. It is worth noting that diphtheria bacilli are found on the mucous surfaces of the nurses less frequently when they leave the hospital than when they begin their service. This is doubtless due to the fact that the habits of personal cleanliness, in which they are instructed, prevent the interchange of secretions, thus allowing the bacilli with which, in common with the general population, they are infected to die out. This could scarcely happen if while in the diphtheria wards they were breathing in the germs. While physicians and nurses not rarely contract disease by mouth-spray infection while leaning over the face of the patient, infection of ward maids and other employees is rare. In the Providence City Hospital the only ward maid who ever became infected was one who ate fruit given her by a scarlet-fever patient. But I was informed by Dr.

Gordon, of the Northeastern Hospital, in London, that in that institution ward maids assist in the care of patients, and are as frequently infected as are nurses.

In concluding, it is well to note that the general trend of laboratory work during the past 30 years has been to show the difficulty or impossibility of the air carriage of living bacteria and other pathogenic organisms. Our brief review shows that clinical and epidemilogical studies are in close accord with laboratory findings. While not many years ago aerial transmission was believed to be the all-important factor in the extension of the contagious diseases, experiment and observation have removed one disease after another from the list of air-borne infections, until most of those who have given the subject careful attention are convinced that, as compared with contact infection, aerial infection is of very minor importance, and is, perhaps, a negligible factor in most diseases.

THE CONTROL OF DISINFECTION AND THE INFLUENCE OF INFECTED ROOMS AND FOMITES IN THE DISSEMINATION OF VARIOUS INFECTIOUS DISEASES.

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In order that this subject may be scientifically and properly considered, it is necessary that we should be familiar with the means by which infectious diseases are transmitted, for without this knowledge disinfection and other methods of protection can not be intelligently carried out.

No theory has been more generally accepted, both by the medical profession and the public at large, than that infectious diseases are commonly transmitted by clothing, baggage, money, rags, and innumerable other articles which are supposed to convey pathogenic organisms in their active state from one person to another. These alleged agents of infection are known as fomites. Even a superficial investigation reveals the fact that the origin of this theory antedates the period of bacteriological or other scientific research, for even as early as the fourteenth century we find that clothing and cargoes of vessels were frequently exposed to the air and sun for an indefinite period for so-called purification, and vessels departing from presumably infected ports were sunk by official order to prevent infection through the medium of their contents. These extreme and unjustifiable methods have not by any means been confined to the past, for in recent years, and even at the present time, sanitary regulations are enforced, particularly in regard to disinfection, which are worthless and unnecessary. It was not so very long ago that iron rails were disinfected in the South to prevent the transmission of yellow fever. Since the discoveries of Pasteur and Koch, which gave to the world indisputable evidence of the germ origin of infectious diseases, and particularly during the past 15 or 20 years, practical sanitariums have been slowly but surely accumulating conclusive evidence of the fallacy of the fomites theory; and although exceedingly valuable pioneer work has been done in this direction, the results have been reluctantly accepted, chiefly on account of the popularity of this belief, which was born in ignorance and has had little to support it beyond the fact that it offers a ready and plausible explanation for the transmission of infectious diseases in instances where the true medium of infection is unknown.

Than this no theory ever entertained has been so pernicious or has militated so seriously against the successful treatment of outbreaks of infectious diseases, for it has discouraged the employment of active, energetic, and exhaustive measures to detect the true cause of infection. Those in charge of the public health, while they have been conscious of its shortcomings, have been disinclined to abandon it, for it has dominated all health regulations, the object of which is to prevent infectious diseases. However, in recent years events have occurred which fortunately have abruptly and positively demonstrated the unsoundness of this theory and have extended valuable aid in bringing about a more active and a more serious consideration of this important subject, for we have learned that the ideas formerly entertained regarding the means by which the various infectious diseases are transmitted are wrong, and it seems to me there can be no better time than the present to condemn the fomites theory and accept the results regarding the transmission of infectious diseases which have been obtained by careful and painstaking scientific investigation.

Not long ago malaria was attributed to the presence of miasma, or poisonous vapors emanating from swamps; now we know that this disease is caused only by the mosquito. We also know that yellow fever, formerly supposed to be commonly transmitted by fomites, is also contracted only through the medium of this insect. The medical history of the South is rich in statistics which presume to offer conclusive proof that the clothing of those who had been exposed to yellow fever was responsible at various times for outbreaks of this disease.

Satisfactory evidence has been given us that plague, which was believed to be caused by almost anything in the way of fomites, is conveyed from one person to another by the rat through the medium of the fleas which infest them. Some years ago I visited Russia during an outbreak of this disease and found many theories regarding the media of infection. Instances were cited where it was transmitted by caravans going from one section of the East to another through the mediums of rugs, clothing, etc. In the light of our present knowledge these theories are unworthy of consideration.

Many have maintained in the face of the warning which has been given in regard to this belief that typhus fever must surely be caused by fomites, and refer to the rapidity of its extension and other details connected with its transmission. It would be difficult to find a textbook which does not in positive terms state that typhus fever is transmitted by clothing, baggage, and other articles; yet careful investigation, particularly that which has recently been carried on in Mexico under the direction of Drs. Goldberger and Anderson, seems to furnish satisfactory proof that typhus fever is not transmitted by fomites, but by the body louse. I originally accepted the general belief regarding the medium of infection in this disease, but my experience during two epidemics has made it quite clear to me that fomites, to say the least, do not constitute the ordinary means of infection. During the outbreak of typhus fever in New York City, in 1892–3, of the 700 or more cases which occurred I remember but two of them which appeared among persons in the better walks of life, almost all being among the lodging or tenement-house population. These people ride in public conveyances with those of other classes, and if clothing constituted a medium of infection there would be no such record as I refer to. On the other hand, those affected are just the ones we would expect to be the host of these insects.

Of the specific organisms involved in smallpox, chicken pox, measles, and scarlet fever we know practically nothing, except probably the information given us by Councilman regarding his investigation of smallpox. There is no doubt that the vesicle or pustule of smallpox contains infectious matter. Of this we have definite proof. It is asserted by some that infection is also present in the vesicle of chicken pox, although we have no evidence of it. In measles and scarlet fever the skin eruption is of a different character, and in neither disease passes beyond the papular stage, and there is nothing to justify the belief that it contains infection. The desquamation which follows the eruption of these diseases has been regarded as an important medium of infection; this also is without satisfactory evidence. Desquamation in itself has no special significance other than to indicate some circulatory disturbance of the skin or some other interference with its function. Filth causes it. It occurs in sunburn and sometimes in typhus fever and other infectious and noninfectious diseases.

I believe that desquamation is a negligible factor in the transmission of measles and scarlet fever and that these diseases are conveyed from one person to another by the infected discharges of the mucous membrane involved. We have so concentrated our minds on the presumed potency of desquamation as a medium of infection that it has obscured the real danger of the infected discharges which are always present in these diseases. I am aware that instances are cited where it would appear that desquamation is the only logical means of infection in secondary cases. Before this can be accepted as scientific or practical evidence, the presence of infected discharges must be excluded. I do not believe this can be done, nor do I believe this is usually considered. I know of many who regard the discharges from the affected membrane in scarlet fever and measles as of secondary importance to desquamation in the transmission of these diseases. Proof is presented that measles and scarlet fever are both transmitted before and after desquamation; besides, it is far more in accord with modern scientific research to believe that the seat of infection is in the mucous membrane involved rather than desquamating scales.

We probably do not fully consider to what extent the fomites and desquamation theories depend upon statements made by the laity. There is hardly a family, particularly where there are children, that can not cite instances to prove, to their own satisfaction, at least, the transmission of these diseases through the means just referred to, and will often present evidence that it has occurred through the medium of clothing which has been laid away for months or even years. Equally positive statements are made regarding the transmission of disease by desquamation. I do not mean that all evidence of this character is presented by laymen. I have investigated much of this evidence, and have yet to see the first case where satisfactory proof of these statements was available or a condition which could not be explained without the aid of the fomites or desquamation theory. Still, under these uncertain conditions we have gone ahead in the investigations of disinfectants and disinfection; we have indicated in detail how the apartments of the sick must be treated and what agents should be employed. It does not seem proper that we should do this until every means is exhausted to ascertain the true media of infection. We construct a foundation before we build a house, and for the same reason we should, so far as possible, know the manner in which infectious diseases are transmitted in order that we may have a proper knowledge of the methods by which we can best prevent them.

It is only within recent years that we have appreciated the importance and danger of mild, ambulant, or irregular cases of infectious diseases and the frequency with which they occur. I regard them as one of the most common and dangerous factors in the transmission of infection, because they often pass unrecognized and are responsible for outbreaks of disease which are attributed usually to fomites.

More recently we have learned of "carriers" or persons who, although they present no evidence of disease themselves, contain specific organisms and may transmit them to others. With a proper knowledge of the means of infection before us, it is not necessary to depend upon either the fomites, desquamation, or the aerial theory to aid us in determining the manner by which infectious diseases are conveyed. I mean by the "aerial theory" the belief that infection is carried for long distances through the air. It is frequently asserted that this may occur even to the extent of half a mile or more. I do not believe in this theory or that there is any substantial or reasonable proof of it.

Until within a few years it has been generally believed that the marked increase in the number of cases of scarlet fever, measles, and diphtheria which occur at the opening of the school season is due largely to the transmission of these diseases by the clothing of the children in whose home infectious diseases exist or who have been exposed to these conditions outside of their home. This belief has been shattered by the work recently carried on in the schools of the larger cities. Here the careful inspection by medical officers, known as the "school corps," has shown to what a remarkable extent mild, ambulant, irregular, or unrecognized cases exist. Children with a slight sore throat, which has not materially interfered with their play or school duty, or the presence of a nasal or ear discharge have frequently been found to be due to a mild case of scarlet fever or diphtheria; or a cold in the head has proved to be due to measles. Before the existence of this exceedingly valuable inspection these cases were overlooked, and secondary ones were attributed largely to the presence of infected clothing. Conclusive evidence of the great frequency of "carriers" has also been presented, and I am sure we will be surprised to learn to what extent they occur and the number of diseases which are involved.

Money has long been regarded as a medium of infection; so have rags, although there is no satisfactory evidence to prove it. It is the superficial consideration of this part of the subject that has misled us. If an employee of a bank contracts infectious disease, it is very apt to be attributed to infected money. If a man who works in a paper manufactory contracts smallpox, the rags with which he deals are usually held accountable for it, unless there is positive evidence of some other means of infection. It is important to ascertain at this point if those who work among rags or those who are constantly handling money contract infectious disease oftener than others do. If not, the evidence does not support the fomites theory, for we must remember that those who are in close contact with these articles are subject to the same general exposure as others, and therefore may contract disease in the ordinary way. During a careful investigation of this part of the subject, which has covered a number of years, I have yet to find an instance which reasonably proves that either money or rags constitute a medium of infection. At the Treasury Department in Washington, where an enormous amount of old and filthy paper money is being constantly handled and rehandled by many employees, no evidence could be secured that money transmits disease. This same result was also obtained in connection with the employees of banks and other institutions where money is being constantly handled. Similar results occurred in connection with the investigation of rags, second-hand clothing, etc., for no proof was disclosed to show that diseases are transmitted in this way. My investigation in connection with rags was carried on both in this country and in Egypt, for the reason that Egyptian rags have been used largely in the United States for the manufacture of paper. They usually consist of the cast-off garments of the natives, which, as a rule, are worn next to the skin. When unfit for further service, they are sold to the ragman or exchanged for pottery for domestic purposes and are taken to Alexandria and there picked over by women and children. Although infectious diseases are commonly found throughout Egypt, I was unable to detect any evidence in the carefully prepared statistics of the English sanitary officers in charge, that rags constitute a medium of infection.

We are frequently confronted with statements that money contains a large number of bacteria. This is true. They also exist on our hands and faces, on our linen, car straps, balustrades of stairways, and in innumerable other places, but they are not the kind of organisms that transmit infectious disease. From a bacteriological standpoint a very interesting series of experiments in connection with this part of the subject was made by Mr. Warren Hilditch, of Sheffield Institute, which demonstrated the fallacy of this theory.

Physicians are frequently concerned regarding the possibility of transmitting disease from one patient to another through the medium of their own clothing. Instinctively they know that this does not happen, or, at least, only in rare instances. Gowns are frequently used in the sick room to protect against this possible danger. I am quite sure those present will agree with me that it would be exceedingly difficult to arrange a practical system by which a physician could always have a gown at the proper time in dealing with the various forms of infectious disease which he meets in his daily practice.

In making application, or otherwise dealing directly with the infected membrane, when sudden expulsion of mucus frequently occurs it is proper that the physician should be protected by some form of covering. In these instances a sheet may be so deftly used as to answer all the purposes of a gown, and should afterwards be treated by heat in the same manner as are other articles directly connected with the patient.

No one who is practically familiar with this subject doubts that, in some rare instances, clothing, money, rags, or other articles may act as a medium of infection. While this should be given proper consideration, we must devote our time in public sanitary work rather to the usual or common means of infection.

If our former theories regarding the means by which infectious diseases are transmitted are wrong, what are the real means of infection?

The knowledge we now possess on this subject proves that infectious diseases are transmitted by persons rather than things, by contact with others, by certain discharges of those who are infected, and by insects and vermin.

We are familiar with the fact that in typhoid fever and cholera it is the intestinal discharge and in diphtheria the discharge from the nose and throat that we must deal with in the protection of the public health, and we know that when this condition is properly looked after the most effective and satisfactory results follow. However, in measles and scarlet fever we have dealt rather indefinitely with the subject of infection, for this "bugaboo" of desquamation has weakened our lines of defense against the real danger—that is, the infected discharges. As the specific organism of these diseases has not yet been identified, it is obviously difficult or impossible to determine when the discharges cease to act as a medium of infection. Still, the problem will be much sooner solved if we direct our attention to the real danger instead of the theoretical ones.

In hospitals, where measles and scarlet fever, as well as other infectious diseases, are treated under the same roof and the wards containing these various diseases are separated only by low or dwarf partitions, which leave the upper part of the wards continuous with each other, there is practically no transfer of infection from one ward to another, neither is room disinfection carried out as a part of the routine work. These results certainly do not favor the desquamation or aerial theory of infection, and it would seem that when careful attention is given to the disinfection or destruction of the discharges from the nose, mouth, and ears, and, above all, where general cleanliness is strictly observed, which I believe ranks higher than disinfection, we have done all that modern sanitation calls for in the treatment of this condition.

Measles and scarlet fever, as well as other infectious diseases, are commonly conveyed from one person to another through the medium of infected hands. Dipping the hands for a moment in a disinfecting solution does not disinfect them, for it takes some time to penetrate the infected material. It is the proper preliminary cleansing of the hands with soap and water upon which protection in this direction really depends.

So far as the transmission of infectious diseases by insects is concerned, it may be said that the investigation of this subject, although yet in its infancy, has already yielded results which have been of great benefit to mankind, and it is fair to assume that there are many other diseases and other insects concerned in this manner of infection of which as yet we have no knowledge. I believe this calls for every effort on our part to eliminate the mosquito by destroying its breeding place, and that the same action should be taken in regard to the fly or other insects which we suspect as agents of infection. But little will be gained in the way of eliminating them by efforts to destroy the winged insects. It is the destruction of their breeding places that must receive our careful attention.

I have dealt at some length upon these details because we can not properly protect against infectious diseases unless we are familiar with the means by which they are transmitted. With this knowledge it is comparatively easy to deal with almost any condition which may exist; besides, the work of protection is more simple and more easily carried out.

Probably no sanitary measure has been so variously dealt with as disinfection. The methods employed are frequently unnecessary and not in accordance with the dictates of modern sanitation. Agents are used which have little or no value; material in households or on shipboard is uselessly injured or destroyed; and when disinfection is actually required it is frequently imperfectly carried out. I may take, for instance, the treatment of the discharges of typhoid fever. The method usually employed consists in placing a disinfectant in the bedpan before or after the discharge, the mixture being allowed to remain for some time before the receptacle is emptied. This method can not be depended upon for thorough disinfection; besides, not infrequently in handling or manipulating the receptacle the nurse or attendant is infected, for she has faith that this treatment answers all requirements. Some time ago I made a series of experiments in regard to this detail. They consisted in the treatment of fecal matter with the various disinfecting solutions which are commonly recommended for this purpose and in the manner in which they are usually employed. It was found at the end of 20 hours that but one-eighth of an inch of the mass was disinfected. These experiments were subsequently repeated by others with practically the same results, and, I believe, prove that this method of treating the discharge does not disinfect, and it is not improbable that, when the fecal matter is thrown in the water-closet or privy vault and disintegrated, it may later infect something which is taken into the mouth.

It is true that the discharges of cholera become rapidly fluid and also more quickly succumb to disinfecting agents; still these conditions are sometimes uncertain, and we should make no exception, when we have means at our command, to secure full protection. Furthermore, it is exceedingly important that the receptacle itself should be disinfected at the same time the discharge is treated, although the attendant does not always fully appreciate this and sometimes does not realize the necessity of cleaning the hands. I believe there is but one way to deal with infected discharges of this kind, if it can be made use of, and that is by heat—either boiling water or steam. Some simple means of performing this may be improvised wherever a metal receptacle of sufficient capacity and a fire can be secured, or a simple and inexpensive apparatus may be made as follows: A sheet-copper receptacle sufficiently large to hold a full-sized bedpan may be easily constructed, having metal supports to raise it above the ground high enough to allow room for a lamp or gas apparatus to secure the necessary heat. The cover should, if possible, be made sufficiently heavy to offset a slight pressure of steam. This, however, is still further provided for by a spout which is attached to the portion of the top not involved in the cover and for the same purpose that a spout is used on a teakettle—to allow the escape of steam. The upper end of this should be connected with a flexible tube, which may be carried out of the window in order that the steam does not escape into the apartment itself. When not used the temperature of the water may be kept short of the boiling point. The addition of a small amount of potassium permanganate will usually prevent any unpleasant odor. The value of this method lies in the fact that when the bedpan is brought from the patient and placed in the bath and exposed to boiling water for 20 minutes we may be certain that both the pan and the discharge are disinfected and it makes little difference what is done with them afterwards. This apparatus is only a suggestion of the principle which may be carried out on a larger scale. In the hospitals which have been under my direction large apparatus were constructed along these lines capable of holding eight bedpans at one time. Steam may be used instead of boiling water. This method of disinfection is valuable in any form of infectious disease for the treatment of discharges or textile fabrics or other articles which may have been directly contaminated.

I am aware that it is possible to disinfect with carbolic acid and other agents, and in some instances it is not practical to use boiling water or steam, but when it can be employed it should take precedence over all other agents. It offers full penetration and its action is certain and prompt. It does not involve danger or expense, and an apparatus for its use can almost always be improvised. Besides, it is the natural disinfectant and will sooner or later be so considered.

A careful study of the means by which infectious diseases are transmitted will teach us that the necessity for disinfection is confined chiefly to infected discharges and articles about the patient that may be directly contaminated, and that room disinfection is an unimportant factor in the prevention of infection that is employed largely in connection with the fomites theory and is supposed to represent a final clearing up at the termination of the case. The truth is we should deal constantly with the infection which is present in order that there may be no terminal disinfection necessary. It is the dependence that is placed upon this which favors carelessness on the part of the nurse or attendant, for the great importance of continued surveillance is not so fully appreciated.

There are instances where extreme carelessness has occurred in the treatment of infectious diseases which may justify the disinfection of the apartment. In smallpox we have proof that the vescicles contain infectious matter and it is the general practice to disinfect the apartment after the patient is removed. although there has been strong evidence presented to show that after the removal of the patient the room ceases to be a medium of infection. I am willing to say that I am not unfavorable to this opinion, and I believe that the statements which have been handed down to us describing the infection which is constantly lurking about the apartment where infectious disease exists, in the form of organisms in their active state, is largely a creature of the imagination. We believe this largely by inference.

I have no desire or intention of overlooking any proper or reasonable means of protection, but I believe room disinfection goes hand in hand with the fomites theory and that both in various ways encourage carelessness. They are discredited and should be replaced by modern methods, which I feel certain offer far greater value.

It may be said that the gases which are used for room disinfection—sulphur dioxide and formaldehyde—have very little power of penetration and can be depended upon only for the most superficial form of disinfection. Furthermore, the sprinkling or spraying of rugs or carpets which may have been contaminated with discharges is not a safe or practical method of disinfection. If these articles are contaminated, they should be subjected to heat—either boiling water or steam.

I believe that nothing is more unreasonable than an attempt to disinfect an entire house, and I can imagine no condition that would call for it unless it is to cater to the wishes of the family.

It is impossible in the limited time given this paper to satisfactorily consider the many details connected with this important subject. I believe the essential ones are that we now have conclusive proof that many of our former theories regarding the means by which infectious diseases are transmitted are wrong, and that in the prevention of these diseases we should in the future carry out such means as are dictated by our present knowledge of this subject, and that theories and measures which are not supported by scientific evidence and practical experience should be discarded.

If this course is followed, we may, as a rule, expect to detect the origin of outbreaks of infectious disease which constitutes the most important and valuable means of dealing successfully with this danger. Further means of protection include the prompt and careful isolation of the patient and the constant disinfection and destruction of infected discharges and articles which may be directly contaminated. The most careful attention must be given to cleanliness. Than this nothing is more important, not only for its great value in the prevention of infection, but for its educational value also.

When the character of the disease calls for it, exhaustive effort should be made to destroy infected insects, and to extend aid in destroying their breeding places. The treatment of those who have been exposed to infection consists in at least a daily examination to early detect the invasion of the disease. This is not complete without the use of the thermometer. The practice of quarantining well persons in whose homes infectious disease exists should disappear with the fomites theory. The danger of these people is that they may contract disease and transmit it by personal contact, and not that they may may transmit it to others by their clothing. Besides, it is best that they should be out of the house. Furthermore, these people are often the breadwinners of the family, and their enforced idleness is a matter of considerable concern.

DISCUSSION.

Dr. VALENZUELA: En considérant l'importance du travail de M. le docteur Doty, je veux savoir l'opinion de quelques-uns des honorables confrères de cette section auprès des moyens de transmission du typhus, de la scarlatine et la rougeole, dont à présent on ne connaît pas les germes. Quelle est l'époque la plus dangereuse pour le contage de ces maladies parce qu'il y a beaucoup d'opinions sur ce sujet?

Quel est le moyen le plus à propos et efficace pour la désinfection dans ces maladies parce que la plupart des cas ne réussit pas?

Je considère très importants ces sujets parce que ne connaissant pas le moyen de transmission aussi bien que le procédé efficace de désinfection pour combattre leur propagation.

Je demande respectueusement s'il faudrait l'accepter comme le moyen le plus sûr maintenant, tandis que la bactériologie fait la lumière sur ce point, soit par isolement et la propreté de l'individu, les robes de lit et leur vêtements. Même en considérant que l'isolement ainsi que la propreté soient le plus soigné possible.

THE PREVENTION OF THE SPREADING OF CONTAGIOUS DISEASES BY INFECTED HABITATIONS OR INFECTED CLOTHES.

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Numerous observations have taught us that the specific germs of many of the most common infectious diseases—for instance, tuberculosis, diphtheria, scarlet fever, variola, et cetera—cling to the walls and furniture of the sick rooms, remain alive a certain length of time, and meanwhile retain their capability of spreading infection, so that, as we know by experience, the sojourn of persons in such a room may be quite sufficient for them to acquire one of these diseases. This fact makes it necessary to use a reliable method of annihilating the infectious microbes in rooms previously inhabited by persons suffering from infectious diseases. In consequence thereof, the disinfection of habitations forms a principal part of our struggle against infectious diseases.

The simpler and cheaper a reliable method of attaining this may be the more general it will become, and it must be one of the principal aims of hygienics to evolve simple and inexpensive ways of disinfection.

At present the most universal way is to evaporate or spray water and formol with an apparatus. Less in use, on account of the expense, although quite as efficacious, are the methods without a special apparatus, as, for instance, with permanganate of potash and formol, or permanganate of potash and paraform.

I have found by numerous trials that the heat which is generated by the slaking of quicklime can be used to evaporate water and formalin, and that if the right amount of the reagents is used the infectious germs can be killed just as surely and in just as short a time as by the other methods. One condition for its efficiency is that the formation of α—acrose, a sort of sugar, be avoided. This is formed when formol comes in contact with hot lime, and can be avoided by adding sulphuric acid to the water with which the lime is slaked.

The amount of the reagents necessary for the disinfection of a room containing 100 cubic meters is as follows: Five kilograms of quicklime, 6 liters of water, 500 cubic centimeters of concentrated sulphuric acid, and 1 liter of formol (10 cubic centimeters of formol per 1 cubic meter room for a 6 hours' fumigation). It is best to put the lime, in pieces of about 80 to 120 grams in weight, into a flat tub with a capacity for holding 25 to 30 liters of fluid. In the tub the solution of the sulphuric acid (about 12 per cent) is poured over the lime. As soon as steam begins to generate the formol is added.

According to the size of the rooms to be disinfected, the amount of the reagents is chosen according to a schedule based on experiments.

Seeing that quicklime is easily procured everywhere and can be kept unchanged for a long time in well-closed vessels, that sulphuric acid is easily procurable and cheap, and that instead of a complicated apparatus only simple tubs or buckets are needed, I consider my method not only the simplest, but also the cheapest.

Considering that the carriage of fluids like sulphuric acid and formol over longer distances is not without difficulties, I have made experiments with a view to substituting the sulphuric acid by some other reagent which is not liquid—as, for instance, oxalic acid, tartaric acid, tannic acid, or permanganate of potash. Up to date the result of these experiments has not been satisfactory. When we consider the importance of a favorable solution of this question, it would seem to be well worth while to continue the experiments in this direction.

Paraform can be used instead of formol, but this makes the method a good deal more expensive.

Quicklime can also be used to evaporate ammonia in rooms disinfected with formol. Pieces of lime of the size mentioned and aggregating 2 to 3 kilograms are barely covered with water in a tub. As soon as heat begins to be generated, about one-third or one-half of the fluid is poured off, and about half as much ammonia as the amount of formol used is poured into the lime.

As the spreading of infectious diseases is frequently caused by the clothes and underwear of the patients, great importance must be attached to the proper disinfection of these objects. If for some reason or other there be an obstacle to the disinfection of the clothes or underwear by steam, the disinfection may be undertaken with formol in a tightly closed cupboard. For the disinfection of a cupboard of 2 to 3 cubic meters in volume, the amount of lime needed is 2 kilograms, over which is poured, in a flat vessel, about 200 cubic centimeters of sulphuric acid diluted with 3 liters of water. As soon as this mixture begins to steam, 70 to 100 cubic centimeters of formol are added.

In making experiments relating to disinfection with formol, different authors use different methods. Cultures of bacteria with different powers of resistance are dried on silk threads or strips of linen or flannel, and these test objects subjected to the influence of the fumes, either directly or wrapped in paper or placed in corners of the rooms.

This disparity between the methods makes it very difficult to judge the real effect of any certain method of disinfection, and it would seem to be in the interest of the whole question if a standard method for these experiments could be agreed upon, and this standard alone be followed in future.

DEMONSTRATION EINES VON M. KAISER (TRIEST) AUSGEARBEITETEN EINFACHEN UND SICHEREN VERFAHRENS ZUR DESINFEKTION VON STÜHLEN AM KRANKENBETT.

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Eingehende Untersuchungen welche u. A. M. Kaiser im Hygienischen Institut der Universität Graz vor Jahren ausführte zeigten, dass die zur Desinfektion des Kots am Krankenbett vorgeschriebenen und eingeführten Methoden versagen, wenn die Excremente fest sind. Kaiser hat seine Versuche, ein einfaches und sicheres Verfahren zur Kotdesinfektion zu erforschen fortgesetzt und in seiner jetzigen Stellung als Seesanitäts-Oberarzt in Triest auch zu einem erfolgreichen Ende gebracht.

Das Prinzip seines Verfahrens beruht darauf, dass die Faeces durch Hitze sterilisirt werden und zwar durch die hohe Temperatur, welche entsteht, wenn gebrannter Kalk mit heissem Wasser übergossen wird.

Vor der Ausführung dieser einfachen aber als absolut sicher erprobten Methode, wird nur von der Warteperson ausgemessen, wieviel Wasser notwendig ist, um in dem zu berührenden Gefäss (Nachttopf, Unterschieber) den dort abgesetzten Kot mit Wasser zu bedecken. Der bei der Defäkation gelassene Harn wird nach Schätzung hinzugerechnet und mindestens der vierte Teil der gesammten Flüssigkeitsmenge Kalk zugesetzt. Der Kalk ist vorher in Stücke zu zerkleinern, welches etwa die Grösse einer Kirsche haben. Die Kalkstückchen werden in gleichmässiger Verbreitung um den Kot gelegt. Ein Abwiegen des Kalks ist nicht notwendig; es genügt den Kalk in einer Porzelanmensur abzumessen und die Raumteile den Gewichtsteilen gleich zu setzen.

Auf den mit Kalk bedeckten Kot wird dann die vorher bestimmte Menge 45°–70° C. heissen Wassers gegossen; bei niedriger Aussentemperatur oder, wenn viel Harn gelassen wurde, ist ein höher temperirtes Wasser zu verwenden. Das Geschirr wird nun mit Zeitungspapier in mehrfacher Lage und einem Holz—oder Porzelandeckel bedeckt. Nach der ersten stürmischen Dampfentwicklung wird der Deckel mit einem Gewicht oder Stein beschwert, um eine zu rasche Temperaturerniedrigung zu verhüten.

In dieser Weise behandelt erhitzt sich der Kot auf circa 85° C. und behält auch nach einer Stunde noch eine Temperatur von mindestens 70°. Nach zweistündigem Stehen wird der Topf entleert; die in ihm enthaltenen Krankheitserreger sind abgetödtet.

Diese überaus einfache Methode, zu welcher also nur etwas gebrannter Kalk und warmes Wasser gehört, hat sich bei zahlreichen Controlversuchen mit Bakterium coli, welches an Widerstandsfähigkeit den Krankheitserregern, die durch den Kot übertragen werden zum mindestens gleichkommt, als absolut sicher erwiesen, sodass die schwierige Frage der Kotdesinfektion am Krankenbette nunmehr in einfachster und sicherster Weise gelöst erscheint: Simplex veri sigillum.

RÉSUMÉ.

1. Die Warteperson oder der Desinfektor hat an dem zu benützenden Gefässe festzustellen, welcher Mengen warmen Wassers es bedarf um den Stuhl damit vollkommen zu bedecken.
2. Zu dieser Menge Wassers wird das Quantum des gelassenen Harns schätzungsweise hinzugerechnet.
3. Dem Stuhle wird gleichmässig verteilt der vierte Teil des Gewichtes der Gesamtflüssigkeit an Kalk zugesetzt.
4. Der zu benützende Kalk ist der gebrannte Kalk (Aetzkalk) der unmittelbar vor dem Gebrauche in kleine etwa kirsch- oder wallnussgrosse Stücke zerschlagen wird. Das erforderliche Quantum kann wenn eine Wage nicht vorhanden ist volumetrisch in einer der gebräuchlichen 250 gr. Porzellanmensuren abgemessen werden, wobei ein Gramm einem Kubikzentimeter gleichzusetzem ist. Der dabei gemachte Fehler ist für den Desinfektionseffekt belanglos.
5. Auf den Stuhl wird die vorher bestimmte Menge 45–70° C. warmen Wassers gegossen, wobei darauf zu achten, dass bei grösseren Harnmengen oder niedriger Aussentemperatur wärmeres Wasser zu benützen ist.
6. Das Geschirr wird hierauf mit einer mehrfach zusammengefalteten Zeitung und einem darüber gelegten Brettchen, einer starken Pappe oder einem flachen Blechdeckel bedeckt und dieser nach der ersten stürmischen Dampfentwickelung beschwert um eine zu rasche Abkühlung zu verhüten.
7. Nach zweistündigen Verweilen kann der Inhalt des Geschirres als ungefährlich ausgeleert werden.
8. Es empfiehlt sich das Verfahren, welches sehr einfach ist dennoch vorher durch die Warteperson einüben zu lassen.

IMPORTANCIA PROFILÁCTICA DE LA DESINFECCIÓN EN LOS SERVICIOS SANITARIOS URBANOS Y INTERNACIONALES.

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La experiencia confirma cada día que la desinfección es un medio profiláctico poderoso para luchar contra la propagación de las enfermedades transmisibles; desempeña un papel esencialmente preventivo y profiláctico ya atenuando la virulencia de los microbios ya impidiendo su conservación, su multiplicación y su diseminación; por ella un medio contaminado deja de estarlo; es un recurso de gran importancia de que el hombre dispone en la lucha diaria contra las enfermedades en cuyos resultados contribuyen como complementos de gran valor el aislamiento y la higiene cooperando ésta con dos de sus elementos más importantes que son la aeración y la limpieza, así como todo aquello se relaciona con el aumento de energía del organismo para hacerlo más resistente á la acción de los gérmenes patógenos y que evita asimismo la fatiga y pérdida de la energía haciendo del individuo un terreno propicio para la invasión y germinación de dichos microorganismos.

Siendo el fin que con la desinfección se propone alcanzar la destrucción de todos los gérmenes peligrosos que pueden estar contenidos en el medio así como los que el individuo emite durante su enfermedad ó después de su curación ó de sumuerte, los cuales fácilmente pueden diseminarse de diversas maneras en el medio exterior y transportadas á largas distancias, interviniendo en ello circunstancias diversas como son el que el enfermo no ha sido reconocido ó está mal atendido ó bien por que el individuo escapa á la observación médica ó por que siendo portador de gérmenes patógenos, con apariencia de sanos, contaminan y diseminan con ellos los objetos que tocan, la desinfección debe intervenir en sus prácticas con toda la amplitud que ella requiere á fin de poder obtener de ella todo el resultado profiláctico deseado.

En el estado actual de la ciencia, la desinfección debe satisfacer condiciones que la despojen de todo aquello que pueda perturbar y desmerecer la confianza de sus exitos, no debe ser, como dice Chassevant, ejecutada como un rito, ni ser aplicada uniforme é indiferentemente de igual manera en todos los casos; mal practicada da una seguridad engañosa y constituye un sério peligro pues permite á los gérmenes que no han sido destruídos propagarse libremente; en resumen la desinfección para que sea efectiva debe ser científica, metódica y completa.

Las medidas de protección que actualmente se toman contra las enfermedades contagiosas se inspiran en el conocimiento de los factores, etiológicos propios á estas enfermedades; los descubrimientos de Pasteur han permitido dar á aquellas una base verdaderamente científica; se sabe que una gran parte de las enfermedades transmisibles tienen un origen microbiano, se sabe igualmente que el contagio resulta siempre de la transmisión del germén patógeno del individuo enfermo al individuo sano ya sea directamente por contacto inmediato, ó bien indirectamente por contagio mediato por intermedio de los productos excretados por el enfermo y esparcidos en su derredor y sobre los objetos que han estado en contacto con él, el conocimiento de esta es de gran importancia para valorizer debidamente los principios fundamentales de la profilaxis; por una parte con el aislamiento se limita el campo de la infección y se impide la diseminación de los agentes contagiosos; por otra con la desinfección, se destruyen los gérmenes patógenos en donde quiera que estos se encuentren.

Es necesario saber que no basta recibir el contagio para sufrir sus efectos nocivos, muchos individuos pueden albergar los gérmenes específicos de una enfermedad contagiosa y servir de vehículos para su transmisión; numerosos casos han sido observados en el colera, la fiebre tifoidea y la diftería; existiendo en estos individuos un estado transitorio que les hace por el momento refractarios á la eclosión de la enfermedad; la noción de estos casos tiene una gran importancia, pues demuestra que la medida ideal de profilaxis sería provocar este estado en el momento en que el contagio lo amenaza; es el principio en que está basada la vacunación para la viruela cuyos resultados son confirmados en el mundo entero, ese estado de inmunidad aunque transitorio, se procura para evitar el contagio de la peste, el cólera, la diftería y la fiebre tifoidea; la inmunización viene á remediar la insuficiencia inevitable del aislamiento y de la desinfección.

Otras medidas profilácticas de orden más general se relacionan principalmente con el individuo; el organismo que funciona regularmente resiste generalmente á la acción de los gérmenes patógenos que en él penetran, el hombre es poco hospitalario á los microbios, pues está dotado de una inmunidad natural; pero si el estado de su salud se altera ligeramente esta inmunidad desaparece y da lugar á la receptividad más ó menos grande; debe pues evitarse toda causa que deprima ó altere el estado normal de la salud del individuo, observando las prácticas que la higiene aconseja tanto en su persona, con cuidados de aseo, limpieza y alimentación como en el medio en que vive.

Aislamiento.—De las medidas sanitarias para la propagación de las enfermedades transmisibles, el aislamiento es de suma importancia, pues como se acaba de decir, por medio de él se limita el campo de contagio, por consiguiente dicha medida debe ser llevada á efecto rigurosamente por las autoridades sanitarias; el aislamiento de un enfermo contagioso en su domicilio es por demás deficiente y esto ocasiona la difusión de las enfermedades transmisibles, muy particularmente entre la gente pobre cuyos elementos no les permite disponer de una habitación medianamente cómoda, pues además de las condiciones propias de las habitaciones baratas que son pesimas, la aglomeración de individuos que en ellas existe empeoran dichas condiciones; que llegan á ser un serio peligro no sólo para la misma familia si no para le salubridad pública en caso de aparecer entre ellos una enfermedad transmisible; en otro medio social, la ignorancia de la facilidad en los medios de transmisión de las enfermedades, hace que el enfermo no sea aislado debidamente permitiéndose la entrada á la recámara del enfermo á personas que visiten á la familia siendo muchas de esas personas los vehículos transmisores de los gérmenes patógenos que diseminan por todas partes; es pues de gran importancia que el aislamiento á domicilio sea permitido sólo en casos en que las condiciones de la habitación y los recursos del enfermo lo garanticen, en las cláses pobres debe ser forzoso el aislamiento en el hospital, quedando la ejecución de este á cargo de la autoridad sanitaria á fin de que la translación del enfermo se haga en vehículos destinados á este objeto; la falta del cumplimiento de esta práctica sanitaria así como á la falta de energía de la autoridad respectiva para dar el debido cumplimiento, es causa sin duda alguna de la fácil propagación de un gran número de enfermedades transmisibles.

Desinfección.—Su objeto es destruir en donde quiera que estén á su alcance, los gérmenes infectantes emanados de cualquier foco de infeción, la desinfección es un complemento indispensable del aislamiento pues aquel de una manera aislada resulta ilusorio, en cambio ella sola puede bastar para extinguir en su origen un foco epidémico; si el ideal al combatir un medio infectado es destruir toda clase de gérmenes; es decir, llegar á la esterilización, el servicio sanitario no exige sólo la desinfección, pues basta hacer desaparecer los microbios patógenos que son generalmente menos resistentes que los microbios saprofitos, porque casi todos ellos estan desprovistos de esporas.

La acción que los diversos agentes desinfectantes tienen sobre los gérmenes que se intenta destruir, debe ser comprobado frecuentemente por medio de gérmenes testigos para asegurar la eficacia del procedimiento empleado; es bien sabido que substancias cuya acción germicida es eficaz, como insecticida deja mucho que desear; tal es la formaldehida; en cambio el anhidrido sulfuroso tiene propiedades contrarias.

Es de gran importancia que además de hacer uso en la práctica de la desinfección de aparatos y procedimientos cuya eficacia han podido ser comprobada, que el manejo de unos y otros sea fácil, rápido y de poco costo, además es de gran importancia tener siempre presente que al prácticar la desinfección no causar ningún desperfecto en los objetos por desinfectar.

Son en la actualidad muy numerosos los agentes de que la desinfección dispone, siendo los principales el calor; las substancias químicas; la formaldehida, sublimado corrosivo, la cal, el sulfato de cobre, el anhidrido sulfuroso, las cresoles y el ácido cianihídrico, y otros de los cuales al hablar de la condición metódica de la desinfección se indica su uso.

Inmunización.—El conocimiento de la etiología de las enfermedades contagiosas permite emplear medios profilácticos para su propagación, un gran número de las enfermedades transmisibles que en otros tiempos ocasionaban un número de víctimas enorme; en la actualidad su contagio se combate por medio de la inmunización con sueros preparados con elementos derivados de los mismos gérmenes específicos que originan las enfermedades que se trata de prevenir.

El suero antitetánico, el suero antidiftérico, el suero antirrábico y los sueros antipestosos de Yersin, Haffkins y Beredeska, la vacuna en fin de Jenner son aplicados como poderosos medios profilácticos eficaces, haciendo inmunes á los individuos á quienes se aplica, ya pasajera ó permanentemente desde luego las ventajas que con estos medios profilácticos se obtienen son indudables, pues que, aun cuando con ellos se confiere una inmunidad transitoria esta inmunidad es precisamente en momentos de mayor peligro para el contagio; las últimas grandes epidemias han podido ser combatidas satisfactoriamente con el concurso de este medio profiláctico que ha desempeñado un papel importantísimo como complemento del aislamiento y de la desinfección.

El adelanto de la bacteriología, logrará sin duda alguna hacer conquistas sobre la etiología de muchas enfermedades hasta hoy desconocida, logrando en estas lo mismo que ha hecho con las que ha podido descubrir su gérmen patógeno, confiriendo igualmente la inmunidad.

En vista de los resultados que frecuentemente los servicios sanitarios de todas partes del mundo obtienen con la inmunización, disminuyendo considerablemente en sus estadísticas y aun suprimiendo en muchas de ellas la morbilidad y la mortalidad causada por estas enfermedades que en otro tiempo se presentaban con el carácter epidémico, impone á las autoridades sanitarias el deber ineludible del fomento y protección de todos los establecimientos que cooperen al estudio bacteriológico y á la preparación y conservación de sueros inmunizantes, pues por considerables que sean los gastos que tales establecimientos requieren jamás podrán ser comparados con los que importan las pérdidas de las vidas causadas por enfermedades transmisibles que puedan ser evitadas por este medio profiláctico.

Medios higiénicos.—Como complemento de gran valor á los medios profilácticos mencionados vienen las prácticas que la higiene aconseja, tanto las que se relacionan al individuo como á la colectividad; el individuo resistirá más á la acción de los gérmenes patógenos, aumentando ó por lo menos conservando su energía; evitando toda fatiga que lo pondría en condiciones de receptividad.

Pero si el individuo debe por todos los medios posibles ponerse al abrigo del contagio con los cuidados personales que la higiene aconseja, en su aseo, habitación, alimentos y vestidos; la autoridad sanitaria debe vigilar el medio en que el individuo colectivamente está colocado, pues que influyendo éste en la salubridad de aquél, igualmente aquel influye sobre todos y cada uno de los que en el viven; el conjunto de estos medios constituye la higiene urbana.

Por medio de la distribución de comisiones de los diversos ramos que este servicio comprende, se podrán vigilar con la atención que requiere las bebidas y comestibles; que sirven con frecuencia de vehículos de transporte de gérmenes ptaógenos.

Los rastros en donde se sacrifican animales que pueden estar enfermos de enfermedades contagiosas y transmitirlas á quienes consuman sus carnes; los mercados cuya variedad de artículos que en ellos se consumen fácilmente pueden estar en mal estado y ocasionar enfermedades de carácter grave en el aparato digestivo.

El aseo de las vías urbanas de los alrededores para evitar la aglomeración de basuras, desechos industriales y animales, los cuales son propicios para el desarrollo de un gran número de insectos, que como las moscas propagan gérmenes patógenos.

El cuidado de las aguas potables tanto lo que se refiere á su cantidad como á su calidad.

En fin los cuidados que se refieren á la higienización de las habitaciones, á fin de que llenen las disposiciones indicadas por los códigos sanitarios.

Así como el conocimiento de la etiología de las enfermedades transmisibles ha establecido la base científica de la profilaxis, igualmente ha servido á las condiciones que ella requiere de ser metódica y completa; metódica, por que en cada caso atiende á la causa de la enfermedad, á la manera de transmitirse, á los medios de propagación y á los procedimientos más eficaces para destruir el gérmen en su origen ó en los vehículos de transporte que facilitan el contagio.

Hay enfermedades que son fácilmente transportables por los desechos del enfermo, que son conducidos por el polvo, por los insectos, por las ropas y por el agua; la naturaleza del germén que la ocasiona indicar la manera de combatirla; dejando de tener los procedimientos empleados el carácter de rutinarios.

La desinfección tendrá que ser completa, pues que atendiendo todas las circunstancias que encierren en cada caso se cuidará tanto del individuo mismo, foco y origen de los gérmenes patógenos, como del medio que lo rodea, considerando en el ropa y toda clase de objetos que están en contacto con él; destruyéndolos en todos ellos por la desinfección de las ropas, de las habitaciones y para la destrucción de los insectos que contribuyen á su propagación.

Los resultados que aplicados en esta forma de los medios profilácticos, en los cuales ocupa el primer lugar la desinfección, tendrán sin duda que ser eficaces.

Profilaxis en el servicio urbano.—Considerando aisladamente los medios de los cuales se dispone en los servicios sanitarios urbanos para la profilaxis de las enfermedades trasmisibles, la importancia de algunos de ellos es relativa, pues por sí solos no bastan á destruir la causa de dichas enfermedades; contribuyen á ello y el resultado de su acción es colectiva; la desinfección en cambio puede destruir por si sola un foco epidémico, ella sola basta para impedir la propagación de muchas enfermedades trasmisibles; este servicio debe por su eficacia profiláctica ser organizado convenientemente á fin de que pueda satisfacer debidamente las necesidades públicas y obtener de él todas las ventajas posibles.

Siendo la reunión de un gran número de personas en un espacio limitado la causa más frecuente de la insalubridad de las ciudades, debe atenderse desde luego á dicha causa para evitarla en lo posible y corregirla opertunamente; el saneamiento del medio urbano propiamente dicho y el de la habitación pueden hacer desaparecer un gran número de enfermedades cuyo origen se encuentra en el individuo; el hombre quede trasmitir directa ó indirectamente los gérmenes del contagio que transporta, desempeñando un papel activo cuando está enfermo ó infectado, ó solamente pasivo siendo el vehículo transmisor é inerte de microbios que provienen de otros individuos ó del medio en que se encuentra colocado.

Para preservar á la colectividad en la cual vive de la trasmisión de las enfermedades cuyos gérmenes lleva consigo es necesario toda clase de medidas cuyo conjunto constituye una verdadera lucha.

Desde que los trabajos de Pasteur han dado á conocer los efectos y trasmisión de los contagios, la lucha contra los germenes patógenos ha obtenido resultados eficaces, se ha conseguido destruirlos en su origen y por medios que la experiencia biológica demuestra su eficacia, se presume la posibilidad de hacer desaparecer las enfermedades que ocasionan, clasificando éstas como enfermedades evitables; es cierto que la desaparición de tales enfermedades será difícil de conseguir y será preciso largo tiempo para lograrlo; pero la realización de esto será posible; actualmente en muchos casos se puede evitar, gracias á medidas oportunas el desarrollo y propagación de muchas enfermedades contagiosas; el comprobante de esto es la disminución de la morbilidad y la mortalidad que las estadísticas manifiestan; entre estas medidas ocupa un lugar preferente la desinfección.

En la organización de un servicio sanitario debe contarse con los elementos siguientes: El diagnóstico precoz de una enfermedad trasmisible; contra estas enfermedades es de gran importancia poder tomar las medidas necesarias lo más pronto posible, pues desde luego se pueden poner en práctica los diferentes medios profilácticos para detener su extensión; además de todo aquello que la terapéutica aconseja; los signos clínicos precoces que se observan en enfermedades de tal categoría sirven para establecer un diagnóstico precoz; la bacteriología presta asimismo grandes servicios para reconocer en época oportuna el gérmen patógeno de muchas enfermedades contagiosas, tales como el cólera, la diftería, la peste bubónica, la disentería, le meningitis cerebro-espinal, la fiebre tifoidea, la tuberculosis, la sífilis y otras; para que datos de tal importancia para la salubridad pública es necesario que su personal técnico sea práctico y entendido para apreciar la aparición de los signos diagnósticos y que el servicio dispongan de laboratorios bacteriológicos para la comprobación de los gérmenes característicos de las enfermedades trasmisibles, los cuales deben estar á cargo de personas competentes.

La adquisición del diagnóstico de una enfermedad transmisible al principio de una epidemía es de suma importancia; es preciso conocer el mal desde su aparición, su localización en tal casa y demarcación para llevar allí el medio eficaz para evitar su propagación; es imposible organizar un buen servício sanitario en una ciudad si la autoridad encargada de vigilar la salubridad pública no tiene conocimiento oportuno de la aparición de los primeros casos de una enfermedad contagiosa; tal es el fundamento de la declaración obligatorio de los casos de estas enfermedades, ordenada en los códigos sanitarios de todos los países, esta declaración es la verdadera base de la organización eficaz de la lucha contra las enfermedades trasmisibles, esta declaración debe ser hecha no solamente por los médicos, sino también por los jefes de familia, los directores de corporaciones y administradores ó jefes de establecimientos públicos; es necesario obtener el convencimiento de todas estas personas que en la declaración de todos los casos de enfermedades contagiosas está la piedra angular de todo el sistema de profilaxis, del cual se debe esperar todo el bien posible; al cumplir con este deber que la ley impone cooperan á una labor que la autoridad inicia y que debe ser secundada por todos y cada uno de los individuos que forman una colectividad, satisfaciendo á la vez el deber que la sociedad y la humanidad les imponen.

Dadas las condiciones de promiscuidad en las habitaciones de las clases pobres en las grandes ciudades, se comprende la facilidad de la propagación de las enfermedades transmisibles; esto hace que la declaración obligatoria de casos de estas enfermedades sea de gran importancia, pues esta facilita la lucha contra su propagación permitiendo una vigilancia eficaz, disponiendo el aislamiento efectivo y la desinfección oportuna ó bien la inmunización por la vacunación.

Las leyes sanitarias indican las enfermedades que deben ser declaradas obligatoriamente, la falta al cumplimiento de estas disposiciones deben ser castigadas severamente.

La declaración de los casos de enfermedades contagiosas tienen como consecuencia inmediata la designación por medio de cédulas que la autoridad sanitaria manda colocar en los sitios más visibles de la habitación infestada; es de gran interés para el público conocer las casas en donde existen casos de enfermedades contagiosas, lo cual se consigue por medio de la cédula sanitaria, esta es una medida excelente, del cual se obtiene resultados profilácticos satisfactorios é influyen mucho en la educación sanitaria del pueblo.

Aislamiento—Desde que un caso de enfermedad contagiosa es conocido, lo primero que se impone es aislar al enfermo lo mejor posible; el aislamiento en la práctica sanitaria como necesario, el código sanitario ordena el aislamiento de los enfermos contagiosos, pero desgraciadamente para cumplirlas debidamente se tropieza con muchas dificultades que hacen que pocas veces se lleven á efecto, destruyendo por completo una de las bases fundamentales de la profilaxis, la energía para el cumplimiento de tales disposiciones indispensable y sólo será permitido el aislamiento en su domicilio á personas que lo garanticen tanto por sus condiciones pecuniarias como por su nivel moral. La clase media y la pobre son las que prestan más dificultades para garantizar la efectividad del aislamiento á domicilio.

La creación de sanatorios y hospitales debidamente acondicionados á fin de inspirar confianza y destruir el horror que estos establecimientos públicos causan, es el medio por el cual el aislamiento de los enfermos contagiosos se llevaría á efecto debidamente pues la autoridad encontraría la ayuda en las mismas familias.

El transporte de estos enfermos debe ejecutarse con todo cuidado en vehículos destinados á este objeto; en lugares en donde no se dispone de recursos suficientes los vehículos que se utilicen para este servicio deberán ser desinfectadas cuidadosamente.

Desinfección.—El enfermo según su afección es por más ó menos tiempo una fuente de contagio. es pues necesario procurar destruir los gérmenes patógenos que de el provengan para impedir su dispersión en el medio exterior y ejercer en el una acción perjudicial á los que en él se encuentren.

Los gérmenes pueden ser trasportados por diversos medios; los esputos, las mucosidades, la descamación epidérmica, la sangre, el pus, las materias fecales, las orinas; todo lo que esté en contacto con el enfermo debe ser considerado como sospechoso y peligroso y debe ser sometido á la desinfección.

Los reglamentos respectivos expresan la indicación detallada de tan importante servicio y así como para el debido cumplimiento del aislamiento, es necesario la energía de las autoridades; para el cumplimiento de la desinfección de las casas de las habitaciones de los enfermos que las leyes sanitarias marcan como obligatoria debe ser rigurosamente aplicada.

El servicio de desinfección de las ciudades es el medio profiláctico por excelencia para evitar la propagación de las enfermedades trasmisibles por lo tanto este servicio debe atenderse convenientemente dotándolo de todo lo que las exigencias de las ciudades requieran, así como de una buena organización.

El local destinado al establecimiento debe ser amplio y contar con los departamentos necesarios para las diversas secciones que el servicio requiere; satisfaciendo como principio fundamental la incomunicación del lado con el lado desinfectado, para que el resultado sea eficaz el personal debe ser suficiente y adecuado á las necesidades del lugar y formado por individuos de mediana instrucción y educación para que se posesionen del papel que desempeñan y de la comisión que se les confia, así como del buen trato que deben dar á la sociedad á cuyo servicio están y cuyos intereses sanitarios se les han confiado.

La dotación de vehículos de trasporte, aparatos y sustancias desinfectantes para que los diversos casos que se presenten sean tratados oportunamente y adecuados á lo que cada uno de ellos exija, satisfaciendo así las condiciones de una buena desinfección cuyos resultados deben ser eficaces pues de lo contrario las prácticas defectuosas en ella constituirían un gran peligro para la salubridad pública.

Medidas higiénicas.—La vigilancia de las condiciones higiénicas de las habitaciones y del medio urbano en general debe ser objeto de atención de las autoridades sanitarias, haciendo cumplir debidamente los reglamentos relativos al alejamiento de las inmundicias, de los desechos animales é industriales que tanto influyen en la propagación de las enfermedades, la vigilancia de las aguas potables así como de las bebidas comestibles requiere cuidados especiales por ser también vehículos de gérmenes patógenos; otros cuidados no menos importantes forman el complemento de la profilaxis urbana; la destrucción de insectos y animales que desempeñan el papel vehículos transmisores de microorganismos de enfermedades transmisibles ó bien ellos mismos llevan consigno el origen de la enfermedad; la rabia, el carbón, el muermo son transmitidos por los animales; todas las medidas que tienden á defender al hombre contra los animales peligrosos corresponden á la policía sanitaria de los animales.

Para completar los elementos de que debe disponer el servicio sanitario urbano, son necesario los laboratorios de sueros inmunizantes para prevenir por este medio tan eficaz el desarrollo y la propagación de las enfermedades transmisibles; son satisfactorios los resultados que las estadísticas manifiestan de las ventajas obtenidas con tales prácticas, disminuyendo considerablemente la morbilidad ocasionada por ellas; la vacuinacíon aplicada profusamente, la inoculación antirábica, y el tratamiento por el suero antitetánico han librado á numerosas víctimas de una muerte seguar.

PROFILAXIS.

Profilaxis en el servicio internacional.—Si en los servicios sanitarios urbanos las medidas profilácticas exigen una gran atención por parte de las autoridades locales; en los internacionales requieren mayor cuidado de los Gobiernos, los primeros luchan contra ciertas enfermedades que los habitantes de cada región conocen y la aparición de los primeros casos permiten tomar las medidas necesarias para evitar su propagación; el interés individual hace que todos y cada uno de los que forman la colectividad urbana, vigilen y pongan en conocimiento de quien corresponda las condiciones de cada caso que se presenta, para proceder oportunamente.

Las enfermedades importadas de países lejanos no ha mucho tiempe eran desconocidas en otros lugares, la rápidez de la comunicación de que se dispone en la actualidad ha hecho que poco á poco los países distantes sean visitados por enfermedades exóticas, lo cual ha permitido la fácil propagación de ellas debido á que desconocidos sus signos característicos no se establece el diagnóstico oportuno y por consiguiente no se toman las medidas profilácticas apropiadas; tal fué lo que paso el año de 1903 en Mazatlán, en donde los primeros casos de peste bubónica fueron interpretados por los de otras enfermedades, dando lugar á su rápida propagación; por fortuna la bacteriología permitió descubrir el agente patógeno de aquella forma epidémica allí desconocida rasta entonces y con actividad digna de elogio por parte del Gobierno Federal y del Consejo Superior de Salubridad, se pudo limitar el foco epidémico y destruirlo por completo en poco tiempo.

La necesidad de protegerse contra las enfermedades contagiosas exóticas desde hace mucho tiempo, ha motivado que los países amenazados dispongan las medias sanitarias para evitar su invasión; durante largo tiempo estas medidas han tenido un carácter particular de cada país, lo que hacía que un mismo barco fuera sometido según el puerto donde tocaba á tratamientos muy diversos, mientras en unos era admitido sin dificultad, en otros era sujeto á cuarentena; se comprende desde luego cuantas dificultades ocasionaba al comercio tales disposiciones, sin tener resultados eficaces para impedir la propagación de las enfermedades que se intentaba evitar.

Conferencia de París, 1851.—Á mediados del Siglo XIX se hizo la primera tentativa de agruparse algunos países de Europa, dadas las facilidades con que se iba haciendo la comunicación entre sí, siendo notable la diseminación de las enfermedades exóticas; la primera reunión que se organizó con tal objeto fué en París el año de 1851; después de laboriosos esfuerzos se consiguió reunir en esta conferencio 12 delegados de los países vecinos al Mediterráneo, representados cada uno de ellos por un médico y un diplomático; se propuso en ella el acuerdo sobre las mejores medidas profilácticas que se debían adaptar relativas al cólera, la peste bubónica y la fiebre amarilla, proponiendo las bases para uniformar un sistema sanitario.

La imposición que los delegados franceses quisieron hacer del reglamento proyectado, fué el principal obstáculo para que fuera aceptado por todos los delegados reunidos y sólo fué ratificado por Francia, Portugal y Cerdeña; el sistema de gobierno de los países que no aceptaron el reglamento teniendo un sistema de gobierno distinto al de Francia no les fué posible aceptarlo.

Á pesar del fracaso de esta conferencia de 1851 que fué la que inició los tratados de la higiene internacional, el Gobierno francés tomó de nuevo la iniciativa para convocar una nueva conferencia en 1859.

Conferencia de París en 1859.—En esta reunión el Gobierno francés procuró evitar las causas que habían ocasionado el fracaso de la conferencia anterior, esta fué formada solamente por diplomáticos, los cuales de igual manera que en la anterior proyectaron una convención, pero establecida sobre bases amplias, sin adjuntar ningún reglamento; á cada país se dejó en libertad para proponer lo que más le conviniera; los acontecimientos políticos de esa época y principalmente la guerra de Italia fueron la causa del fracaso de esta segunda conferencia.

Conferencia de Constantinopla en 1866.—La epidemia del cólera importada de Egipto y de allí á Europa por los peregrinos de la Meca motivó la tercera conferencia, organizada también por el Gobierno francés; la reunión de los delegados tuvo lugar en Constantinopla á donde concurrieron los delegados de las potencias europeas, los de Egipto y Persia; el número de los países representados fué de 17, llevando la representación de éstos un médico y un diplomático.

El objeto de esta conferencia fué la investigación de la causa primordial del cólera, estudiar sus caracteres y proponer los medios prácticos para circunscribirlo y sofocarlo en su origen; los trabajos con este fin se prolongaron ocho meses, durante los cuales el Dr. Fauvel, inspector general de servicios sanitarios de Francia, tomo una parte muy importante.

En esta conferencia se llegaron á determinar datos etiológicos precisos y se estableció para la profilaxis del cólera reglas relativas por una parte á las medidas higiénicas, las mas á propósito para impedir el desarrollo de esta enfermedad, tales fueron el saneamiento, la desinfección, el aislamiento y la interrupción temporal de las comunicaciones entre los lugares infectados; por la otra, á las medidas que debían tomarse en Oriente; teniendo por principio las medidas restrictivas conocidas anteriormente y ejecutadas convenientemente que fueran menos perjudiciales para el comercio y las relaciones internacionales y los trastornos y perjuicios que sufrían las industrias y las transacciones comerciales á causa de la invasión del cólera fueran los menos posibles, aplicando las cuarentenas más cerca del foco original de la enfermedad haciendo dichas medidas menos onerosas y más eficaces.

No obstante los prolongados trabajos de esta conferencia no se resolvieron en convención; sin embargo de ellos resultaron notables trabajos aceptando la reglamentación sanitaria todos los países que habían tomado participación en ella, principalmente Inglaterra y Turquía.

Conferencia de Viena en 1874.—Esta conferencia fué reunida bajo los auspicios del Gobierno austro-húngaro á instancias de Rusia, tuvo por objeto revisar los trabajos de la anterior, considerando la etiología del cólera y las medidas contra esta enfermedad, así como establecer una comisión sanitaria internacional permanente; pero el fin principal que se propusieron las dos potencias organizadoras de esta conferencia, fué la supresión de cuarentenas marítimas que perjudicaban considerablemente su comercio en el Mar Negro y el Danubio.

Los principios establecidos en Constantinopla en 1866 relativos á la etiología del cólera fueron confirmados, pero en lo que se refería á las cuarentenas la opinion se dividió: los delegados del norte sostenían que toda cuarentena era inútil; los del sur opinaban lo contrario; esta lucha se terminó por una transacción por la cual cada nación dejaba á cada cual el cuidado de defenderse conforme sus intereses; la conferencia adoptó dos sistemas: la inspección médica y las cuarentenas; en cuanto á la institución de la comisión sanitaria internacional permanente, se le confiaría el estudio de las enfermedades epidémicas y su profilaxis; esta última no tuvo verificativo.

Conferencia de Wáshington en 1881.—El Gobierno de los Estados Unidos convocó á esta conferencia, comprendiendo 23 representantes; siendo éstos en su mayor parte diplomáticos, ministros encargados de negocios y cónsules, contándose entre ellos muy pocos representantes técnicos; el objeto principal de esta reunión fué la profilaxis de la fiebre amarilla, no obstante que la invitación dirigida á los Gobiernos indicaba la organización de un sistema internacional de notificación del estado sanitario de los diferentes países en donde las enfermedades epidémicas, el cólera y la fiebre amarilla principalmente podían aparecer.

Los delegados estudiaron las dos proposiciones que se les hicieron; El establecimiento de un sistema internacional de notificación sobre la existencia de enfermedades pestilenciales y el sistema internacional de patentes de salubridad expresando la verdadera condición de los puertos y de los buques en el momento de su partida; á pesar del objeto tan limitado de esta conferencia, se obtuvo de ella una utilidad real; en ella se aprobaron diez disposiciones bajo el nombre de resoluciones y se proyectó la primera una convención.

Conferencia de Roma en 1885.—El Gobierno italiano convocó á esta conferencia á donde concurrieron 27 delegados de otras tantas naciones; en ella se propuso como en las conferencias anteriores de Europa, uniformar las medidas sanitarias en los diversos países haciéndolas más eficaces y menos perjudiciales para el comercio; los representantes de las naciones en estas conferencias fueron exclusivamente técnicos, quedando pendiente las resoluciones de las proposiciones que en ella se hicieron, por manifestar aquellos el deseo de someterlas antes á la aprobación de sus respectivos Gobiernos; los delegados no volvieron á reunirse, los trabajos de esta conferencia no tuvieron ninguna importancia; entre si formaron conclusiones, sin tener ningún carácter de convención, para formar un código de policía sanitario internacional relativo al cólera y á la fiebre amarilla.

Convención de Venecia en 1892.—En Venecia se abrió el período de las convenciones sanitarias; las entrevistas y reuniones anteriores entre los representantes diplomáticos y técnicos de las diversas naciones tuvieron en ella por fin un resultado tangible y un gran número de ellas se adhirieron á una reglamentación uniforme.

Catorce países estuvieron representados en esta conferencia, y los asuntos principales que trataron fueron: 1°, las determinaciones que se debían tomar respecto al arreglo formado en Londres el 29 de julio de 1811 entre Austria-Hungría y la Gran Bretaña, relativo al tránsito en cuarentena por el canal de Suez; 2°, las modificaciones que se debían introducir en la constitución del Consejo Sanitario Marítimo y Cuarentenario de Egipto.

El programa fué ampliado, los buques en tránsito por el Canal de Suez fueron divididos en tres categorías idemnes, sospechosos é infectados, para ser tratados según su estado por una comisión médica establecida en Suez.

En esta convención se modificó el reglamento sanitario Egipcio para ponerlo conforme con los principios que se habían establecido con los peregrinos de la Meca.

Convención en Dresde en 1893.—En la reunión internacional que tuvo lugar en esta ciudad solamente nueve naciones fueron representadas; en ellas se puso á discusión " Las medidas que se debían tomar para proteger la salubridad pública en tiempo de epidemia colérica."

Entre estas disposiciones una de las más importantes fué la notificación de los primeros casos de cólera en un país; las demás se referían á las determinaciones de las mercancías ú objetos susceptibles de propagar el cólera considerados bajo el punto de vista de prohibición de importación ó de tránsito y desinfección; las medidas en las fronteras terrestres, en los caminos de fierro y en las carreteras; las medidas que debían tomarse en los puertos, muy particularmente con los muy cargados, como los barcos de emigrantes y los que se encontraran en malas condiciones higiénicas y las medidas que debían observarse para los buques especiales del Danubio, procedentes de un puerto contaminado subiendo el río.

En el número de las disposiciones aplicables á los viajeros por mar y tierra está indicada " la vigilancia á domicilio " que substituyó á la observación, con excepción de los buques infectados; en esta convención de Dresde se adhirieron las potencias representadas y además la Gran Bretaña y Serbia.

Convención de París en 1894.—La convención de Dresde confirmó las resoluciones de la de Venecia; proponiendo que se reuniera una nueva asamblea á fin de reglamentar las medidas para los peregrinos de la Meca y la vigilancia sanitaria que debía establecerse en el Golfo Pérsico; estas cuestiones se sometieron á las deliberaciones en la convención de París en la cual estuvieron representadas 16 naciones.

La convención de París fué ratificada por 13 países; los Estados Unidos, Suecia, Noruega y Turquía no estuvieron de acuerdo.

Convención de Venecia in 1897.—La aparición de Bombay de una enfermedad que hacia mucho tiempo no se presentaba, la peste provocó entre las naciones europeas una viva inquietud y las incitó bajo la iniciativa de Austria-Hungría á invitar á una nueva conferencia con el objeto de reglamentar las medidas que debían tomarse para prevenir la invasión y la propagación de la peste y la vigilancia sanitaria que debía establecerse en el Mar Rojo y el Golfo Pérsico; en esta convención se reunieron 18 representantes de otros tantos países.

La convención que nació de estos trabajos fué más extensa que la de los precedentes; en esta se consideraron y completaron algunos puntos que se habían tratado en la conferencia de 1892 y 1893, de la primera la profilaxis de la peste, las disposiciones á los navios procedentes del Mar Rojo y Canal de Suez, así como la de los puertos árabes en la época de regreso de los peregrinos y de la segunda, la notificación de la aparición de las enfermedades epidémicas, en las condiciones de que una circunscripción debe ser considerada contaminada, las medidas en las fronteras de tierra y mar, tratamiento de las mercancías y medidas aplicables á los barcos de un puerto contaminado subiendo por el Danubio; de la convención de París, se reconsideraron mejorándoles las disposiciones relativas á las peregrinaciones de la Meca.

Convención de Paris en 1903.—La fálta de homogeneidad en las conclusiones de la segunda convención de Venecia fué la causa que motivó esta, la cual tuvo lugar en París del 10 de octubre al 3 de diciembre de 1903 á la iniciativa del Gobierno Italiano; en ellas estuvieron representados 24 países; nuevas observaciones vinieron á añadirse á los datos científicos sobre las cuales se habían basado las medidas prescritas contra la peste en 1897; el papel que las ratas desempeñaban en su propagación estaba fuera de duda; en esta conferencia se preconizó la destrucción de las ratas y atenúo las disposiciones relativas á los buques y á los países contaminados adoptando modificaciones que correspondían también al cólera. Los descubrimientos relativos á la etiología de la fiebre amarilla fueron el punto de partida de otras modificaciones relativas á la profilaxis de esta enfermedad; adaptándose en esta reunión la idea que había sido propuesta en Viena en 1874 de la creación de una oficina internacional de salubridad, la cual se establecería en París.

Á esta convención se adhirieron en 1907, 15 naciones europeas, los Estados Unidos y el Brasil.

La convención de 1903 relativa á la peste, al cólera y la fiebre amarilla constituye verdaderamente la reglamentación en conjunto, perfectamente amplia para acomodarse á la organización de cada país, suficientemente precisa para dar á los buques que frecuentan los puertos de las naciones adheridas á la convención el beneficio de un régimen sanitario uniforme.

Convenciones de 1904 en Río Janeiro y de 1905 en Wáshington.—Estas dos convenciones tuvieron entre Repúblicas americanas conclusiones que son el corolario de la de París.

En la convención de Wáshington se hicieron adiciones relativas á la fiebre amarilla; otras conclusiones tenidas en esta convención han obedecido á la distancia á que se encuentran de los países de Oriente y el poco interés que tiene para ellos la defensa sanitaria del Canal de

Suez, del Mar Rojo y del Golfo Pérsico, en cambio lo relativo á la fiebre amarilla es de gran interés para las Repúblicas americanas siendo la defensa de esta la principal de América.

Las últimas convenciones han tenido lugar en 1907 en México; en 1909 en Costa Rica y en 1911 en Santiago de Chile y en 1912 en París; en ellas se ha reconciderado los mismos puntos que en la de París de 1903 y en la de Wáshington en 1905.

Siguiendo el curso que desde la primera reunión sanitaria de 1851 en París hasta la última de 1912 en la misma Capital de Francia, se vé la importancia que ellas han tomado, pues comenzando por conferencias de escasa importancia en su principio evolucionaron tomando el carácter de convenciones ya entre los países de la misma región, cuyos intereses sanitarios eran comunes; ya con el de internacionales en las cuales intervenían países más ó menos distantes, relacionados por lazos comerciales y geográficos, ya, en fin, con el de intercontinentales en las cuales toman parte todas las naciones del mundo, unidas todas por el interés comun, el de la humanidad; á medida que el progreso humano avanza en el sendero de la ciencia sus relaciones se facilitan tanto comerciales como intelectuales; abreviando las distancias que en otro tiempo los separaban; esta facilidad en la comunicación de los países más remotos ha tenido por consecuencia la transmisión de enfermedades exóticas en otro tiempo desconocidas en lugares lejanos del origen de aquellas; esta confraternidad mundial ha terminado por unir los intereses de toda la humanidad, haciendo que los Gobiernos de cada nación sin perjudicar los intereses comerciales de cada una de ellas, proteja igualmente el bién más preciado del hombre que es la salud.

Después de la serie de conferencias y convenciones que se han verificado con los diferentes caracteres expresados, ha venido á ponerse de acuerdo con la adhesión unánime de las naciones que á ellas han concurrido; los principales puntos son los siguientes:

I. La notificación de las epidemias, condiciones que permiten considerar una circunscripción contaminada y sana.

II. Medidas sanitarias á la partida de los buques y durante la travesía.

III. Medidas sanitarias á la llegada de los buques.

IV. Medidas relativas á las mercancías.

V. Defensa sanitaria del Mar Rojo y Peregrinación de la Meca.

VI. Protección sanitaria del Golfo Pérsico.

VII. Medidas sanitarias en las fronteras de tierra.

VIII. Oficinia Internacional de Higiene Pública.

IX. Profilaxis de la fiebre amarilla.

El resúmen de los asuntos que se trataron en la Convención de París de 1912 fueron los siguientes:

TÍTULO I.

Capítulo I. Disposiciones generales. Prescripciones que deben observar los países signatarios de la convención desde que la peste, el cólera ó la fiebre amarilla aparezca sobre su territorio.

Sección I. Notificación y comunicaciones ulteriores á los otros países.

Sección II. Condiciones que permitan considerar una circunscripción territorial como contaminada ó vuelta sana.

Sección III. Medidas en los puertos contaminados á la partida de los buques.

Capítulo II. Medidas contra los territorios contaminados.

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Con un anexo al reglamento relativo al tráfico de trenes en cuarentena por los territorios Egipcios, de los viajeros y valijas procedentes de países contaminados.

El conocimiento de la etiología y de la profilaxis de un gran número de enfermedades transmisibles, ha hecho que las disposiciones sobre las prácticas sanitarias internacionales haya sido modificada á medida que la ciencia ha conquistado por medio de la bacteriología el conocimiento de los infinitamente pequeños, encontrando asimismo medios eficacaz para neutralizar sus efectos determinando la inmunidad por la vacunación ó para destruirlos en su origen por medio de la desinfección y el aislamiento.

El conocimiento del medio de propagarse las enfermedades, de los medios prácticos para destruir los gérmenes, de preservarse dentro de los animales que les sirven de vehículos, ha permitido substituir á las antiguas cuarentenas, la desinfección, la desrratización y la vigilancia sanitaria bajo las formas más suaves aceptadas por todas las naciones.

Debemos pues felicitarnos del progreso cuyos beneficios disfrutamos en la época actual, dando un voto de agradecimiento y admiración á Francia, por haber sido la organizadora de la primera conferencia, cuyas prácticas sanitarias por empíricas que fueron han tenido el mérito de la iniciativa y á los Gobiernos y sabios de las demás naciones que han contribuído á la evolución de una ciencia, la higiene internacional que es de gran utilidad á la humanidad entera.

RESULTS OF THE SERUM TREATMENT OF EPIDEMIC MENINGITIS.

Simon Flexner, M. D., from the Laboratories of The Rockefeller Institute for Medical Research, New York.

So long as the infectious diseases can not be entirely controlled by measures of prevention they must be opposed by curative means. The direct mode of infection in epidemic meningitis is by way of the upper respiratory tract upon the mucous membrane of which meningococci become implanted. Mere implantation is, however, insufficient to cause meningitis, since many more persons carry meningococci upon these mucous surfaces than develop the disease itself. The number of such meningococcus carriers varies with the extent to which meningitis prevails, so that it is during epidemics that the number is greatest. Unanimity of belief is still wanting as to whether the meningococci ascend to the meninges directly by way of the lymphatic connections existing between the nasal mucosa and the cerebral pia-arachnoidal membranes, or whether they reach the membranes of the brain and cord indirectly through the circulating blood.

Moreover, there still exist epidemiological factors relating to epidemic meningitis that are not understood, and it follows that the time has not yet arrived at which its entire suppression can be hoped for or achieved.

Hence it is that a specific means of treatment is of such high importance. Such a specific means is provided by the antimeningitis serum, and what I have to present to you is based upon a large experience with this serum. During a period of nearly five years the Rockefeller Institute distributed the serum gratis throughout the United States and to many foreign countries in which epidemic meningitis prevailed. The foreign countries embraced Great Britain and Ireland, France, Denmark, Germany, Switzerland, Syria, South Africa, Australia, Greece, and still others. The serum was supplied in as large quantities as were desired and came to be employed at all periods during the prevalence of the late pandemic of meningitis. Many reports of cases treated with the serum were sent in, and I am enabled, therefore, to present certain statistical results based upon an analysis of these reports. In many instances returns were also made of cases of epidemic meningitis occurring simultaneously which were not subjected to the serum treatment. These act as checks upon the others and serve to indicate the average mortality of the disease at the place and time when unopposed by a specific means of treatment. Thus a basis of comparison is afforded that is more accurate and convincing than general figures relating to the mortality of the disease.

The average mortality among cases treated otherwise than with the serum was more or less remarkably uniform in different parts of the globe and under varying conditions of city and country life. It varied from 60 to 75 per cent. In a few exceptional instances, embracing small groups of cases, the mortality fell to about 50 per cent and it rose in others to 90 per cent. These inequalities readily obliterate each other, so that the fact stands out that the factors determining the fatal issue or recovery in cases of epidemic meningitis are strikingly alike among different peoples and under highly dissimilar social states.

The incidence of the disease is greatest in early childhood and the largest number of cases arise during the first five years of life. The next succeeding years of childhood supply the majority of the remaining cases of the disease, while the number of adults affected is proportionately smaller. It is only when the epidemic is extensive that many adults are attacked. In certain localities the percentage of adults has been considerably higher than this rule requires. But this exception has not been sufficiently investigated to disprove the point, since it may readily happen that the disease has been overlooked in infants in whom the diagnosis, except by lumbar puncture and bacteriological examination, is far more difficult to establish.

The fatality varies also with the age of the patient. It is highest in the first two years of life, in which period few have escaped. The mortality in this age period has rarely been less than 90 per cent, and has often risen to 100 per cent. In the period between 2 years and 5 years and especially between 5 years and 10 years there exists a far greater tendency to spontaneous recovery, so that the average mortality may sink to 40 per cent and may not rise above 60 per cent. A rise occurs in early adult life and another rise in the period of manhood which produce mortalities ranging from 60 to 80 per cent.

These differences are in part accountable by factors that operate especially in the different age periods. Infants are especially subject to hydrocephalus to which those fall victims that do not succumb to the acute infection. Adults, on the other hand, appear to be more subject to the rapidly advancing, explosive, or fulminant form of the disease. Patients of the intermediate period are less subject to both these accidents.

There are two periods of greatest mortality. They are the first three days of illness or at the height of the acute attack, and next, later than the second week when serious complications, among which is hydrocephalus, have arisen or the infection has become chronic. As many as one-third may succumb within the first period and a somewhat greater number within the second. The disease is accompanied or followed by complications and sequelæ, the most serious of which are hydrocephalus, deafness, and blindness. Transient paralyses are moderately frequent and permanent paralysis infrequent. Impaired mentality occurs rarely.

I have studied the reports returned from various parts of the world of 1,294 cases of epidemic meningitis treated with the antimeningitis serum supplied by the Rockefeller Institute. This number does not include two large series of cases which were reported to me after the figures given were already compiled. One of these relates to the cases treated in Athens by Dr. Christomanos at the Annunciation Hospital, and the other relates to cases that arose in Louisiana in the spring of 1912 and were treated by the psysicians generally of that region. The two series embrace about 400 cases and formed parts of severe and extensive epidemics. They are especially significant on that account.

The percentage mortality of the 1,294 serum-treated cases was 30.7, or one-half that of the lowest average mortality of the preserum period. This figure should first be considered according to the stage of the disease at which the treatment was begun. There were 199 cases treated within the first three days of the illness in which the mortality was 18.1 per cent, and 346 cases treated between the fourth and seventh days of illness in which the mortality was 27.2 per cent, while of 666 cases treated later than the seventh day of illness the mortality was 36.5 per cent. Even this last figure shows great gain over the average mortality rate.

These figures are significant for another reason. In the preserum period more than one-third of the cases of epidemic meningitis succumbed within the first three days of illness. A part of these—how large we do not know accurately—were victims of the fulminant disease, but not all. It is still an open question whether the explosive type of the disease can be arrested by the serum; but the high percentage of recoveries and the correspondingly small percentage of fatalities among the cases treated within the first three days of illness leave no doubt that the ordinarily severe type of the disease terminating within the first three days of onset is subject to a high degree of control by the serum. A similar effect is shown in the period after the seventh day of illness, which comprises the greatest number of fatalities. To ascertain precisely the value of the serum in late stages of the infection the analysis should be carried out in detail, so as to separate the cases that came under serum treatment many weeks after the onset from those coming under the treatment within the first 7 to 14 days. This will doubtless be done when the published figures become large enough to make the analysis instructive and convincing. What should be remarked now is that in not a few cases that have endured many weeks benefit was afforded by the serum. An otherwise hopeless, or apparently hopeless, case of subacute or chronic meningitis has frequently been promptly arrested by serum administration. Our knowledge at present is such that it is not possible to state the period of the disease at which benefit from the administration of the serum is wholly excluded, except, of course, advanced cases of hydrocephalus and emaciation in young children.

The reduction in the age mortalities brought about by the serum is also striking. Among 125 infants below 2 years of age treated with the serum one-half recovered; the mortality, therefore, was 50 per cent. This is already a considerable gain. Among these 21 infants were injected with serum within the first three days of illness, of which 17 recovered. The fatality was less than 20 per cent. After the seventh day of illness the outlook is far less promising. Of 104 cases thus treated only 46 recovered—a fatality of 56 per cent. Among 201 children ranging in age from 2 to 5 years 171 recovered; the mortality was therefore 15 per cent, which figure separates into the two rates of 10 per cent among those injected within the first week of illness and 20 per cent among those injected later than the seventh day.

I wish now to submit some data relating to adults who have come under the influence of the injections of serum, for which I have chosen the miscellaneous age period of 20 years and over. The number of cases analyzed is 288, of which 180 recovered and 108 died.

The death rate is, therefore, 37.5 per hundred. This figure propounds the question of whether adults are less subject to the action of the serum or have a more highly mortal form of the disease. I have already alluded to the fact that adults furnish a greater number of fulminant examples of meningitis than do children. It may prove, indeed, that children can be more readily and surely saved than can adults by the serum. But it is significant that wherever groups of adults suffering with epidemic meningitis have come under the treatment of an experienced physician the discrepancy was not noted. Apparently, then, experience in the employment of the serum counts far more in treating adults than in treating children, who show a greater tendency to recover spontaneously.

In contrasting the fatality of serum-treated cases with that of cases treated in other ways I shall confine myself to the two sets of figures from Louisiana and Athens in Greece. They possess the merit of being taken at the onset of severe and highly fatal epidemics in which no selection of cases was made. Cases were or were not treated with the serum according as it was available or as the patients had the confidence of the physician in charge. As far as I know, no case was excluded because it was unfavorable or included because it might be favorable to the action of the serum. The Louisiana cases numbered 250, of which 176 were treated with serum and 74 were not treated. Among the former the fatality was 30 per cent and among the latter 85 per cent. The difference is striking. We may now consider here the effect of race on the mortality. Among the serum-treated cases were 67 white persons and 109 colored persons. The percentage fatalities are the same, namely, 30 per cent. Hence both races respond alike to the serum and probably to the infection, except so far as social conditions determine a difference, for when the fatalities among white and colored are compared under conditions in which the serum was not applied the latter are at a disadvantage. Thus among 27 white patients not given serum 20 died, a mortality of 74 per cent, while among 47 colored patients also denied the serum 43 died, a mortality of 91.5 per cent. It seems probable that the great difference in the social conditions of white and colored persons in the South determined that one had far better care, nursing, and attendance than the other, to which I am disposed to ascribe the disparity noted.

In Greece the fatality of non-serum-treated cases of epidemic meningitis is known to me only from the figures of the Annunciation Hospital. Prior to the introduction of the serum treatment it was about 60 per cent. Dr. Christomanos has reported upon 186 serum-treated cases, among which the mortality was 22.6 per cent.

There are still other aspects of this subject that could be dwelt on, such as the effect of the serum treatment on the duration of the active symptoms of the disease and upon the complications and sequelæ. These points, important as they are, must be deferred to another time. In conclusion it remains to say that the evidence adduced would seem to show convincingly that in the antimeningitis serum a means has been afforded of reducing materially the mortality from epidemic cerebrospinal meningitis. But to accomplish this important result the serum must, first, be active, and, next, be applied by subdural injection in one or more, or even many, doses, until the local infection and inflammation are arrested and brought under control.

PREVENTIVE MEASURES AGAINST EPIDEMIC MENINGITIS.

Dr. A. Sophian, Kansas City, Mo.

This paper will deal with the subject of preventive measures against epidemic meningitis.

Epidemic meningitis is an acute infectious, contagious disease, caused by the *Diplococcus intracellularis*, which is transmitted principally through the medium of healthy carriers; that is, healthy people who harbor the organisms in their noses and throats. During an epidemic many healthy people, especially members of families in which the disease occurs, are carriers. The number of carriers is much greater than the number of those ill with the disease; some observers estimate that the carriers are 10 to 20 times the number of the sick. Only a small percentage of carriers develop the disease; the danger, however, that anyone who is a carrier may develop meningitis or transmit the organism to other healthy people is a very serious menace, and causes considerable alarm, especially in an epidemic invasion of the disease in all sections of a city, as no one knows whether he and his friends are carriers or not.

The occurrence of more than one case of meningitis in families is not so rare as is believed by many; in the recent Texas epidemic there were many instances in which two members developed the disease, and in a smaller number three, four, and five members became infected.

Most writers agree that it is necessary to treat contacts. Stewart, in his review of the subject in the Medical Annual for 1910, mentions Setler's case, where a man, who had been infected three months before, returned to his regiment with the meningococcus still present in his nasopharynx. Seven days after his arrival 10 men out of 30 in his part of the barracks were found to have become carriers.

Systematic prophylaxis against epidemic meningitis, therefore, must consist in active measures against all known carriers, both healthy and sick, and during an epidemic must include measures which can be employed by everybody in an infected community.

The treatment may be classified into (1) quarantine; (2) medicinal treatment, local and internal; (3) specific treatment, (*a*) serum prophylaxis, (*b*) active vaccination.

1. Quarantine is the most important step in the control of an epidemic; quarantine of the sick and of as many known carriers as possible. A number of cities have established arbitrary periods of quarantine lasting from 10 days to several weeks. The fallacy of such arbitrary time limit is that a carrier may remain positive for a long time. If quarantine measures be employed, they ought to be controlled in an accurate way. This can best be done by the cultural examination of the secretions, both of the sick and of contacts. By this means carriers can be positively identified and quarantine instituted. Likewise, quarantine can be raised only when the culture becomes negative. Several thousand people were so examined in the last Dallas epidemic; many carriers were discovered and were prevented from infecting other healthy people, in addition to learning that they harbored a dangerous bacterium, so that they could employ active prophylactic measures.

At first glance, it would appear to be very difficult to cover a large city during an epidemic. Experience has proved, however, that this work can be quite efficiently done, if systematically planned. In Dallas, the work was carried on from a central station. Several assistants were sent out daily to the quarantined homes; each assistant carrying enough swabs and cultural material for from 10 to 20 families. A simple method is to use ordinary throat culture swabs, and Loffler's blood serum slants, as suggested by Hachtel and Haywood. After 18 hours' incubation at 37° C., slides were stained from the growth with Gram stain. If Gram negative cocci were found, a loop of the growth was subinoculated on several other slants, after first carrying it through several water blanks. Typical discrete meningococcus colonies can usually be easily separated in this way. Another method, which I frequently employ, is to make streak plates on glucose ascitic agar, direct with the swab. Typical plate colonies usually develop after 18 hours' incubation; on morphology alone these colonies can usually be quite definitely differentiated from the other Gram negative cocci. Cultures were taken of the sick during their convalescence; if negative, the patient was discharged when well; if positive, cultures were repeated at three to four day intervals. Cultures were similarly taken from all contacts, especially the members of the family, or neighbors, who had been exposed to the sick. If the cultures were positive, they were repeated at regular three to four day intervals, until negative, when the quarantine was lifted. Even if the original culture of an immediate member of an infected family was negative, an arbitrary period of quarantine of a week to 10 days was enforced, since we know that cultures may be negative one day and positive the next.

The examination of the direct smear alone of the nasopharyngeal mucus is interesting, but of no practical value.

Circulars were sent to all quarantined homes, and to the public at large, explaining the contagious character of the disease, the portal of entry of the organism, and its mode of transmission. Especial attention was called to the importance of preventing attacks of common cold, and of strictly preserving the principles of hygiene. They were advised to keep the mouth clean, and to keep the homes properly ventilated and clean. They were warned against promiscuous spitting, and against congregating in crowded places. The schools were closed temporarily.

Fumigation: On release from quarantine, the home of meningitis patients should be carefully fumigated in the regular way.

Medicinal treatment: (1) Local: The object of local application, such as sprays and inhalations, to the nose and throat, is to disinfect and free these parts of the meningococcus.

Bethge, treating 60 carriers in an institution, divided them into six groups. The first was treated with pyocyanase; the second, with hydrogen peroxide; the third, with serum used as a spray; the fourth, with protargol; the fifth, with 1 per cent salt solution, and the sixth received no treatment at all. He concluded that hydrogen peroxide preceded by salt solution gave the quickest results. Hatchell and Haywood controlled an institutional outbreak among 200 children, by isolating all the carriers, as proved by culture, then treating them with sprays, and releasing them from quarantine as their cultures became negative. Before this treatment was begun, a number of cases of meningitis developed among the children; after it had been instituted, no further cases developed, the healthy carriers were promptly rid of the organisms, and the disease was stamped out of the institution. In the few cases treated, they obtained quickest results with the antimeningitis serum used as a spray.

Stewart mentions that chlorine water and menthol were used for disinfecting purposes.

The following are the detailed instructions for the disinfection of the nasopharynx as issued by the French Army in 1910:

1. All carriers must have the nasopharynx, mouth, and tonsils carefully disinfected by antiseptic inhalations and swabbing.

2. For inhalation, the following mixture, first suggested by Vincent and Bellot, is recommended: Iodine, 12 grams; guiacol, 2 grams; thymol, 25 centigrams; alcohol, 60 per cent (200 grams). In order to dissolve the iodine, 6 grams of iodide of potash should be added to the above.

This mixture is put into a porcelain dish, which is floated in a basin of boiling water. The patient is directed to sit with his head bent over this at a few inches distance and to inhale the fumes, breathing slowly through each nostril; the sitting should last two or three minutes and should be repeated five times in 24 hours.

Disinfection of the pharynx is carried out by swabbing with glycerine containing 3 per cent of iodine, the swabbing to be done most carefully morning and night.

For disinfection of the mouth, they recommend a gargle containing 20 parts of peroxide to 180 parts distilled water, the mixture being supplied to each man in a separate corked bottle.

Dr. Du Bois and Miss Warren, who were associated with me in the research laboratory, tested a number of antiseptics against the meningococcus, and found that hydrogen peroxide, in one-half to 1 per cent strength, and argyrol 9 per cent destroyed the meningococcus quicker than others which could be used as a spray. During the Dallas epidemic the most generally used antiseptic was peroxide, one-half per cent, as nose spray and gargle, preceded by a cleansing douche with salt solution. This treatment, in most instances, rendered the parts antiseptic within a few days, and, in persistent cases, rarely longer than 10 days.

Internal medication: Urotropin is split up after ingestion into formaldehyde and ammonia, for the most part in the urine; the products, however, are secreted through other mucous membranes; thus its use in cholecystitis. Recently it has been described as being secreted through the nasal and nasopharyngeal mucosa. Its secretion in the cerebrospinal fluid was first described by Cushing and Crowe. This remedy, therefore, would tend to disinfect, at least to a certain extent, the portal of entry, e. g., nose and throat, of the meningococcus, and would also be secreted into the cerebrospinal fluid. Flexner found that the preliminary administration of the drug in monkeys afforded some protection to the animal against the poliomyelitis virus which was later inoculated to produce experimental poliomyelitis.

I advised the use of this drug, as a prophylactic, in doses of 20 to 30 grains a day, in the last epidemic in the Southwest. It was used quite extensively. In most instances where the drug was used local sprays and gargles were also employed, so that the effect of the drug alone in clearing up carriers could not be studied. It would be instructive to make such observations in subsequent epidemics.

Specific treatment: By specific treatment I mean the production of a specific immunity. This may be produced by injecting serum, causing a passive immunity, or by injecting vaccine, causing an active immunity.

Jochmann, in his original publication on the antimeningitis serum, mentioned the feasibility of using the serum prophylactically. Similarly, Ruppel, in 1907, advised its use, recommending 20 cubic centimeters as a dose. The use of this serum to produce prophylactic passive immunity is analagous to the use of other immune sera for this purpose, such as diphtheria and tetanus antitoxins, and plague serum. The dose of the antimeningitis serum as a prophylactic must necessarily be arbitrary, depending on the standard of immunity of the serum. An average dose is about 10 cubic centimeters. The serum should be injected subcutaneously, as one injects diphtheria antitoxin.

This measure has not been generally or systemmatically employed, except in isolated instances, and by different observers. During the Texas epidemic I advised the more extensive use of serum as a prophylactic, especially for those who were very intimately exposed to the disease. Many physicians and nurses were injected, and a considerable number of contacts. In no instance did the disease develop within a month after the injection (this being the outer limit of the time during which one would expect protection). One case, a porter in the meningitis hospital, developed meningitis six weeks after serum vaccination. It is interesting to note that he had no anaphalactic symptoms on the spinal injection of serum for therapeutic purposes.

There are a number of serious objections to the use of serum prophylactically:

First. The fact that the immunity produced is merely temporary, as in all passive serum therapy, lasting only several weeks.

Second. The frequent occurrence of serum sickness, due to the injection of a large quantity of unrefined serum.

Third. The danger of producing anaphylactic shock if the subject subsequently develops meningitis, thus necessitating the therapeutic use of the serum. This danger, however, is no greater, in the repeated use of this serum, than in the use of other immune sera which we know are extensively employed, the doses being frequently repeated at irregular intervals, and being only very rarely complicated by symptoms of severe anaphylactic shock. It would be advisable, however, to first use a small subcutaneous injection of serum if the patient immunized prophylactically with the antimeningitis serum subsequently develops meningitis, and later injecting the serum therapeutically in the regular way.

It may be noted here that it would be interesting to observe the effect on positive meningococcus carriers after the injection of a prophylactic dose of immune serum.

A résumé of the various remedies so far described shows that while a number are of very considerable value none are absolutely certain in their protection. The local measures described disinfect, but do not otherwise protect against the disease; the serum protects only temporarily, and has a number of other objections to its use. The desirable prophylactic would be a measure free from danger that could be used widely with little inconvenience, which would afford a high degree of protection against the disease, at least for several months. Such is typhoid vaccine against typhoid.

The utilization of active immunity as a means of preventing meningitis has not, I believe, been previously advocated.

The work of a number of observers has demonstrated the fact that a considerable degree of immunity develops during the course of the active infection in epidemic meningitis.

Meakens demonstrated the third order of immune body in the blood by complement fixation and employed this test for diagnosis.

Many observers have demonstrated agglutinins in the blood of meningitis patients. Some, as Von Lingelsheim, 1906, Kutscher, 1906, and Krumbein and Schatiloff, have described uniform results in testing immune serum plus the meningococcus. Von Lingelsheim used killed cultures for his tests and declared that the test could be used for diagnosis. Most observers, however, as Trautmann and Fomme, Eberle, Ditthorn and Gildermeister, Lieberknecht, 1906, Elser and Huntoon, and Arkwright, have had irregular results in the test, the main objections being the want of uniform reaction of an immune meningococcus serum with different strains of meningococci and the fact that there is cross agglutiniation between the meningococci and other Gram-negative cocci. Also certain strains of meningococci are inagglutinable, and the agglutinating properties of any strain may change during cultivation. Thus Elser and Huntoon obtained agglutination with one strain of meningococcus in dilution of 1:400 with serum of a meningitis case, while four other strains of meningococci agglutinated only up to 1:50. One week later the most agglutinable strain became unusually sensitive to nonspecific agglutinins and was agglutinated in a 1:100 dilution by serum of a typhoid patient.

Davis studied eight cases of meningitis and obtained positive reactions in dilutions of 1:50 in all; in one case, 1:500 dilution.

The increase of opsonins has similarly been demonstrated by many observers. Houston and Rankin made opsonic determinations on 63 cases of meningitis and found high opsonic readings after the sixth day of the disease, all showing an opsonic index over four and a number showing much higher readings. Davis demonstrated a decided increase in the opsonic index in some cases examined, but not in others. He vaccinated himself with a very large dose of dead culture, injecting the full growth of several small blood-seram slants, and found a marked immediate increase in opsonins. He found no evidence of a negative phase. Von Eberts and Hill, Birnie and Smith, vaccinated a few epidemic meningitis patients with meningococcus bacterin and found a considerable increase in opsonins following inoculation.

McKenzie and Martin, in the Glasgow epidemic, used and recommended the use of the blood serum of meningitis patients, especially of those recovering from the disease, to be used therapeutically by intraspinal injection. Some improvement was obtained by this method. This might be considered as the clinical demonstration of immune bodies in the blood serum.

Immune bodies have been demonstrated in the cerebrospinal fluid of epidemic meningitis patients. Thus precipitins have been demonstrated by Vincent's method, and positive complement fixation has been recently demonstrated by Bruynoglie, of Brussels. He successfully employed this test for diagnosis. It was of special value in those cases in which the meningococci were few and hard to demonstrate.

Thus immune bodies have been demonstrated in those ill with meningitis, both in the blood and cerebrospinal fluid. There was a marked response in opsonins in the meningitis cases treated with vaccine.

In smaller animals, especially rabbits, and in larger animals, such as sheep and horses, there is prompt response in the production of immune bodies after repeated vaccination. These facts, plus the apparent analogy of this disease (which probably begins in most, if not all, instances as a primary bacteriemia) to other bacterial diseases, such as typhoid, and the wonderful results obtained by extensive prophylactic typhoid vaccination, led me to employ and advocate this measure in the recent Texas epidemic.

The absolute demonstration of this efficiency of this measure must be determined by experimental evidence, by the demonstration of a large immune body content following the administration of the vaccine, and by clinical evidence of protection against the disease as observed during epidemics, especially among those who have been exposed to the disease.

EXPERIMENTAL EVIDENCE.

This work was taken up by me, with the assistance of Dr. Black, in the Southwestern Medical College at the end of the Texas epidemic. For this purpose 11 medical students volunteered to be vaccinated.

Preparation of vaccine.—All glassware was chemically neutralized and sterile. An organism, about 5 generations old, isolated from the cerebrospinal fluid of one of the patients in Dallas, was used. It was grown on 2 per cent glucose agar; after 18 hours' growth it was washed off in distilled water, shaken for 20 minutes in the usual way, then heated at 50° C. for one hour and tested for sterility. It was counted by the Wright method, and standardized.

Vaccination.—Eleven students were vaccinated. They were inoculated subcutaneously just below the deltoid; five were injected with 500,000 bacteria as the first dose, and five were injected with 1,000 million. Seven days later they were vaccinated again, with the same vaccine, in doses of 1,000 million and 2,000 million, respectively. Again, a week later, they were vaccinated a third time, with 2,000 million of a freshly prepared vaccine.

Observations were made on the blood count and the general and local symptoms. Their sera were examined every four days for agglutination and complement fixation.

Blood analyses.—The examination of the blood showed, in practically all instances, a slight leucocytosis 24 hours after the injection, with return to the normal on the fourth day. There was very little change noted in the total differential blood count. The leucocytosis was greater after the second and third injection.

AGGLUTINATION STUDIES.

Technique.—Macroscopic agglutination tests were made. The blood was collected from the finger in small glass capsules; the serum was separated and dilutions were made.

Culture.—The Elser-Huntoon organism (which these authors have found especially good for the purpose), which gives no spontaneous agglutination and is readily agglutinable by immune serums, was used. Uniform emulsions of culture were used.

After mixing, the culture and the immune serum were incubated for two hours, then placed on ice for 12 to 24 hours before reading.

TABLE 1.—*Agglutination studies.*

Case no.	No. of injection.	Dose (millions).	Days after first injection.	Agglutination readings.												
				20	40	60	80	100	200	500	1,000	1,000	1,500	2,000	2,500	
1	1	500	6	+++	–	–	–	......	......	......	......	......	.....	.....	.....	
	2	1,000	11	+++	++	++	++	+++	......	......	......	......	.....	.....	.....	
	....	......	14	......	......	......	......	+++	+++	+++	......	–	.....	.....	.....	
	....	......	21	......	......	......	......	......	......	+++	–	–	.....	.....	.....	
2	1	500	6	++	+++	+++	–	......	......	......	......	......	.....	.....	.....	
	2	1,000	11	+++	+++	+++	+++	+++	......	......	......	......	.....	.....	.....	
	....	......	14	......	......	......	......	+++	+++	+++	+++	+++	.....	.....	.....	
	....	......	21	......	......	......	......	......	......	......	......	+++	+	–	.....	
3	1	500	6	+++	+++	+++	......	......	......	......	......	......	.....	.....	.....	
	2	1,000	11	+++	+++	+++	+++	+++	......	......	......	......	.....	.....	.....	
4	1	500	6	±	±	±	......	......	......	......	......	......	.....	.....	.....	
	2	1,000	11	++	++	++	++	......	......	......	......	......	.....	.....	.....	
9	1	1,000	6	++	+++	+++	......	......	......	......	......	......	.....	.....	.....	
	2	2,000	11	+++	+++	+++	+++	+++	+++	......	......	......	.....	.....	.....	
7	1	1,000	6	+	++	+++	......	......	......	......	......	......	.....	.....	.....	Control.
	2	2,000	11	++	+++	+++	+++	......	......	......	......	......	.....	.....	.....	–
	....	......	14	......	......	......	......	+++	+++	+++	++	++	–	–	.....	–
	3	2,000	21	......	......	......	......	+++	......	......	......	+++	+	–	.....	–
8	1	1,000	6	+++	+++	+++	......	......	......	......	......	......	.....	.....	.....	–
	2	2,000	11	++	+++	+++	+++	+++	......	......	......	......	.....	.....	.....	–
	....	......	14	+++	+++	+++	+++	+++	+++	+++	+++	++	–	–	.....	–
	3	2,000	21	......	......	......	......	......	......	......	......	+++	++	±	–	–
10	1	1,000	6	+++	+++	+++	......	......	......	......	......	......	.....	.....	.....	–
	2	2,000	11	+++	+++	+++	......	......	......	......	......	......	.....	.....	.....	–
	....	......	14	......	......	......	+++	+++	+–	......	......	......	.....	.....	.....	–
	3	2,000	21	......	......	......	......	+++	++	......	......	......	.....	.....	.....	–

DISCUSSION OF TABLE 1.

1. The highest agglutination was obtained in those patients who had been given three injections of vaccine; the larger doses used apparently gave a somewhat higher fixation than the smaller doses.

2. Patient 10, who was vaccinated three times with the large doses, did not form agglutinins over 1 to 200.

3. Patient 2 formed agglutinins up to 1 to 1,500 after two injections of 500 million, and 1 million, respectively.

4. The agglutinins increased after the repeated dose and apparently developed in the larger quantities about a week after the injection.

COMPLEMENT FIXATION TESTS.

Technic.—1. Serum: This was collected as for the agglutination tests, inactivated at 55° C. for one-half hour, and dilutions were made in normal salt solution.

2. Antigen: A polyvalent meningococcus antigen was used, prepared by McNeil, of the Research Laboratory, Health Department, New York City. This antigen is prepared as follows:

(*a*) The culture is grown on a slant of salt-free veal agar, neutral to phenolphthalein, for 18 or 24 hours.

(*b*) It is washed off in distilled water.

(*c*) It is then heated in a water bath for 2 hours at 56° C.

(*d*) It is then centrifugalized for about 20 minutes; supernatant fluid is taken off, and sediment thrown away.

(*e*) It is immediately passed through a Berkefeld filter.

(*f*) Next it is put into hermetically sealed capsules and heated to 56° C. for one-half hour, on two successive days, for sterility.

(*g*) It should then be stored in ice box; it may be kept for several months.

(*h*) Before using it should be brought up to 0.9 per cent tonicity by adding one part of 9 per cent salt solution to 9 parts of antigen.

(*i*) It must be titrated before using.

This antigen is specific for the meningococcus serum and, according to McNeil, is not fixed by the gonococcus and other serums. To prepare a strong fixing antigen not so specific, longer autolysis should be allowed after heating. The important point to remember in preparing this antigen for specificity is not to allow too long autolysis; the less time allowed for autolysis the more specific the antigen. The Berkefeld filter must be neutral.

In this series of tests both the highly specific antigen was used and also the less specific, longer-autolyzed antigen, which was prepared later from the culture used in vaccination, and which gave somewhat sharper fixation than the more specific antigen.

3. Guinea-pig complement: Fresh complement was used; also some frozen complement one week old, which proved to be perfectly active. (Dr. McNeil called my attention to this fact.)

4. Sheep corpuscles.

5. Antisheep amboceptor.

The last was done at one-tenth the volume of the usual Wassermann, thus saving material and enabling one to work with the small quantities of blood collected from the finger.

Titrations of all materials were done at the time of the test.

Table 2.—*Complement fixation.*

Case No.	No. of injection.	Dose (millions).	Day after first injection.	Complement fixation.							
				10	20	30	50	100	150	200	250
1	1	500	6	±	±	±	....	....	....	....	....
. .	2	1,000	11	++	++	++	++	+	....	....	....
	. . .	....	21	....	....	....	....	+++	+++	+	−
2	1	500	6	±	+	|	....	....	....	....	....
	2	1,000	11	++	++	+++	++	++	....	....	....
	. . .	1,000	21	....	....	....	....	+++	++	++	....
3	1	500	6	±	±	±	....	....	....	....	....
	2	1,000	11	±	±	+++	+++	+++	....	....	....
4	1	500	6	+ |	++	+++	....	....	....	....	....
	2	1,000	11	+++	+	+++	+++	+	....	....	....
5	1	500	6	+	+++	+++	....	....	....	....	....
9	1	1,000	6	±	±	±	....	....	....	....	....
	2	2,000	11	+	+	+++	+++	+	....	....	....
7	1	1,000	6	+ |	+++	+++	....	....	....	....	....
	2	2,000	11	±	+	+++	+++	++	....	....	....
	3	2,000	21	....	....	....	....	+++	+++	+ |	−
8	1	1,000	6	+++	+++	+++	....	....	....	....	....
	2	2,000	11	++	++	+++	+++	+++	....	....	....
	3	2,000	21	....	....	....	....	+++	+++	++	±
10	1	1,000	6	|	±	±	....	....	....	....	....
	2	2,000	11	+	++	+++	±	+	....	....	....
	3	2,000	21	....	....	....	....	++	++	+ |	−

DISCUSSION OF TABLE 2.

1. Immune bodies could be demonstrated by complement fixation as early as the fourth day after the first injection (not recorded in the table).

2. The highest fixation was obtained in dilution of 1:250, and occurred about three weeks after the beginning of vaccination. The highest and sharpest fixation occurred after the three injections of vaccine, though high fixation up to 1 to 200 occurred at the third week, after only two injections.

3. Note the fact, well demonstrated in cases 3, 9, 7, and 8 on the eleventh day after injections, that much sharper fixation was obtained in the higher than in the lower dilutions of the serums. This observation had been previously noted by me in the course of some work on meningococcus strain differentiation by complement fixation, done by Dr. Neal and myself in the Research Laboratory, New York City, in 1911.

DISCUSSION OF EXPERIMENTAL STUDIES.

1. There is a leukocytosis for a few days following vaccination.

2. There is a prompt response in the formation of immune bodies, which appear four days after the first vaccination, and disappear rapidly after the repeated injections.

3. Agglutinins develop in larger quantities and more rapidly than the third order of immune body, agglutination being obtained at 1:2500 dilution in some cases at the end of three weeks.

4. By complement fixation one could obtain sharp fixation at 1:200 at the end of the third week, this being a high degree of immunity.

5. Apparently the very large doses did not produce much higher immunity than the smaller doses used.

6. Three injections appeared to give desirable results; the doses of 500 million, 1,000 million, 1,000 million, would seem to be sufficient.

7. All of the students vaccinated responded; No. 10, however, did not develop a very high degree of immunity.

REACTION FOLLOWING VACCINATION.

The reaction following vaccination with the doses mentioned consists principally of some local inflammation at the site of injection, and usually some trivial general symptoms. All symptoms are very much improved or entirely gone in 24 hours.

Local reaction.—About four hours after the injection an area of inflammation, consisting of redness, some swelling, and induration appears, which grows larger during the next few hours, and is frequently quite painful and tender. The neighboring glands may become somewhat enlarged and tender. After 24 hours most of the inflammation disappears.

At the next injection, the local reaction may be much more marked and extensive, and may be accompanied by a large area of erythema several inches in diameter.

It is seen that the reaction described is very similar to that occurring in other bacterial vaccinations, as in prophylactic typhoid vaccinations.

General reaction.—General constitutional symptoms may be entirely missing. Frequently, however, there is some malaise, frontal headache, and slight elevation of temperature lasting for 24 hours. Other times there may be more severe general symptoms: The patient may suffer from very severe frontal or vertical headache, may have some general bodily pain, nausea, and vomiting, with rise of temperature to 102°, 103°, or 104° F. These severe symptoms are somewhat unusual. Herpes, usually labial, is occasionally seen.

It is well to remember that the soluble products of the dead meningococcus also appear to irritate the meninges at times, even in the smaller doses used in vaccination, so that one may occasionally see some clinical signs of meningeal irritation, this being evidenced principally by very severe headache, vertigo, vomiting, and photophobia. There may be some pain at the nape of the neck, but no interference with free motion. Other active signs of meningitis are missing, however; the patient does not appear acutely sick, and improves rapidly in a few hours. This symptom-complex is very unusual, but it is well to remember it, so as not become unduly alarmed.

Davis, in studying the effect of the dead culture on the normal person, injected himself with a very large dose of culture, much larger than that recommended for vaccination. He experienced very severe headache, vomiting, chill, high fever, and general bodily pain for several days, accompanied by marked prostration.

Observation will have to be made on many who have been vaccinated to determine the efficacy of the measure, especially observations during epidemics and among those who have been intimately exposed to the disease. At present, the data obtained during the last epidemic are insufficient as a source of any deductions. Hall, of Kansas City, vaccinated about 50 families—in all, about 280 people—in whom the disease had occurred, giving each the full three vaccinations. Likewise, a number of nurses and physicians were vaccinated. In none did the disease subsequently occur. In Dallas a number of people, about 100, were vaccinated. As far as could be learned, very few, if any, had the full number of prescribed injections. Two nurses, each of whom had two injections, developed the disease some weeks after the vaccinations; both recovered. In view of the fact that neither had had the full dose, that irregular records were kept, and that no examination of the blood was made to determine the degree of immunity produced, one can not give too much weight to such occurrence. Reports appear in the literature, similarly, of typhoid developing occasionally after full vaccination, but more often after incomplete vaccinations, and likewise of smallpox after smallpox vaccination. It is well known that immunity does not develop equally well in all the vaccinated, and that at times, in a very small percentage, there may be little response to vaccinations, accounting for the failures occasionally seen.

THEORETICAL OBJECTION TO THE USE OF VACCINE.

The theoretical objections to the use of vaccine as a prophylactic in this disease are the same as in other diseases, being principally the production of a negative phase during which time the patient may develop a general infection if the infective organism be present in any of the tissues. This is seen in inoculation with tuberculin in tuberculous patients, and is well illustrated in the prophylactic vaccination by typhoid vaccine. Here there have been only isolated instances, among many thousands vaccinated, of the development of typhoid shortly after the vaccination which might be explained by the occurrence of a negative phase. In those who have been vaccinated by meningococcus bacterin many have been intimately exposed to the disease; probably the majority were carriers; a number were proved carriers. It is very questionable, especially if a small dose be used the first time, whether the negative phase would be sufficiently marked to allow entrance of the organism from the nose and throat into the general system, with the production of the acute disease.

From our knowledge of the negative phase; from the experience with the prophylactic vaccination against other diseases, such as typhoid; and from the experience in the several hundred prophylactically vaccinated against the meningococcus who showed no authentic case of meningitis following the injection of vaccine which could be explained by the negative phase; and from the fact that many of the vaccinations were made on positive carriers, in whom the danger would be supposed to be most serious, one is warranted in assuming that the prophylactic injection of vaccine against menigitis, especially if only a small first dose of vaccine be used, is attended with little danger of predisposing temporarily to a true attack of meningitis, and that the risk to positive carriers in vaccination is relatively little as compared with the possibility of their developing meningitis without vaccination.

To a certain extent this danger may be obviated by taking preliminary cultures of the nose and throat before vaccination. If positive, it might be advisable to first use local treatment till the culture becomes negative. In at least six instances, however, in which the nose and throat cultures were positive, vaccination was promptly followed about a week later by negative cultures without other treatment.

The only other objections to the use of vaccine prophylactically are slight temporary local and general reactions, which, in a majority of instances, are trivial.

SUMMARY.

1. Observations will be made during the next year to determine the persistence and duration of the immunity produced by vaccination. It is very probable, however, that the immunity lasts a long time, at least a year.

2. It is desirable at the present time that the blood of all the vaccinated be examined, to determine whether any immunity has been produced, and that records be kept.

3. Vaccination is followed by an immediate febrile reaction, leukocytosis, and increase in immune body content, as determined by agglutination and complement fixation tests.

4. Complement fixation tests will probably give most satisfactory results; the agglutination and opsonin tests with the meningococcus, as with other gramnegative cocci, frequently giving very irregular results.

5. All evidence, especially the experimental, points to the efficacy of the injection of dead meningococcus for prophylactic vaccination as a measure which would confer considerable immunity in most cases, and probably partial in all, against the infection of epidemic meningitis. It is very likely that only a moderate degree of immunity will give very considerable or complete protection against epidemic meningitis (which is caused by an organism of low virulence) infecting only a very small percentage of those who are exposed and who temporarily harbor the organism in their noses and throats.

6. It is very likely that if the disease subsequently develops in those vaccinated it will be considerably modified and run a much milder course, with much better outlook for recovery, as is seen in those who develop smallpox after vaccination.

7. The vaccine is prepared, as described, by heating to 50° C. and standardizing in the usual way. These injections, repeated at intervals of a week, in doses of 100 million, 500 million, and 1,000 million, would appear to afford a high degree of protection. The smaller doses used in the experiments produced almost as high a degree of immunity as the larger doses. This corresponds somewhat to the conclusion reached by Smith and Brooks in their work on typhoid vaccination. They state that the response to immune body formation in nearly all cases apparently increases with increasing doses of vaccine. This increase becomes relatively less and less as the dose increases, and its progress suggests that with sufficiently large doses a limiting value might be reached which, if not actually a true limit, would be practically such a limit.

ÉTIOLOGIE DE LA MÉNINGITE CÉRÉBRO-SPINALE.

M. le Dr. Rouget, professeur d'hygiène au Val-de-Grâce.

Des multiples questions que soulève l'étude de la méningite cérébro-spinale, un certain nombre, grâce aux travaux parus dans ces dernières années, paraissent suffisamment au point aujourd'hui pour ne plus donner lieu à discussion. Telles sont par exemple, la sympatomatologie de l'affection, ses diverses modalités cliniques, ses moyens de diagnostic, sa thérapeutique par les sérums spécifiques, etc.

Par contre, il en est d'autres sur lesquelles l'accord est loin d'être fait. Parmi ces dernières, il faut citer notamment ce qui a trait à l'étiologie et à la pathogénie.

Sans doute, nul ne conteste présentement que la méningite cérébro-spinale dite épidémique, soit l'œuvre du diplocoque de Weichselbaum; sa nature infectieuse et sa spécificité sont admises partout et par tous. Mais les divergences commencent dès qu'il agit de savoir si l'affection est ou non contagieuse, d'où provient le virus qui engendre la maladie, quels sont les facteurs qui favorisent et développent son activité pathogène. En d'autres termes, on ne s'entend pas sur le mécanisme par lequel naissent, s'entretiennent et se propagent les épidémies.

Or, le plus haut intérêt s'attache aux données étiologiques de cette infection naguère encore si meurtrière et si grave, car seules elles peuvent permettre de prévoir et d'organiser une prophylaxie véritablement rationnelle et efficace.

Par suite du manque d'espèces animales douées d'une réceptivité analogue à celle de l'homme, l'expérimentation n'a pu serrer de près le problème et chercher une solution à toutes ces inconnues. Jusqu'à plus ample informé, on ne saurait donc émettre à leur sujet que des hypothèses. Quoiqu'il en soit, à défaut de preuves expérimentales, il se trouve des faits d'observation d'où l'on peut tirer quelques leçons, et, si l'on n'est pas autorisé à en déduire des certitudes, on peut, du moins, aboutir à des probabilitiés qui ont leur importance en la matière, et dont il convient de faire son profit.

L'histoire enseigne que les États-Unis d'Amérique ont été, à diverses reprises, le foyer de sévères épidémies de méningite cérébro-spinale; le moment ne peut donc être mieux choisi pour discuter sur un sujet qui préoccupe tous ceux qui ont souci de l'hygiène et de la prophylaxie.

L'étiologie de la méningite cérébro-spinale, dite épidémique, est interprétée différemment par les médecins. Leurs conceptions particulières permettent de diviser la majorité en deux camps: les partisans de l'autogenèse et ceux de la contagion.

L'autogenèse, a dit le Professeur Kelsch qui en a été un des promoteurs, et qui, jusqu'à ses derniers jours, a défendu cette doctrine avec la haute autorité qui s'attache à son nom, ne doit pas être prise ici comme synonyme de génération spontanée, de création de germes nouveaux. Elle ne vise que les modifications qui se produisent dans le degré de virulence de l'agent microbien, par analogie avec les variations en plus ou en moins que Pasteur a réalisées dans l'activité de certain virus.

D'après cette théorie, le méningocoque peut, pendant un temps plus ou moins long, végéter indifferent, comme un saprophyte banal, mais, à la faveur d'influences diverses, il est susceptible d'accéder progressivement à la virulence et de devenir momentanément pathogène.

Que la méningite se manifeste sous la forme sporadique, qu'elle prenne une allure épidémique, ou même qu'elle s'élève à la hauteur d'une véritable pandémie, ces modalités demeurent fonction des modifications intrinsèques apportées par les contingences extérieures dans la virulence du méningocoque. Ainsi s'expliquent les particularités qui caractérisent l'évolution des épidémies dans le temps et dans l'espace.

Toutefois, on doit à la vérité reconnaître que Kelsch ne niait point la contagion; il la considérait comme possible, mais il ne lui accordait qu'un rôle tout-à-fait secondaire, effacé par conséquent dans la propagation des atteintes et l-extension des épidémies. Quelques disciples sont allés plus loin que le maître, car ils so refusent à admettre la contagiosité.

Bien différente est la deuxième théorie. Elle rattache tout cas de méningite à un cas similaire antérieur, avéré ou méconnu. Quelle que soit la distance qui les sépare dans le temps ou dans l'espace, les diverses atteintes s'enchaînent en une sorte de lignée ininterrompue; elles se relient par voie de filiation. En d'autres termes, c'est la contagion seule qui règle et résume toute la pathogénie de l'affection.

Telles sont les deux principales doctrines actuellement en présence; leurs conceptions, comme on le voit, sont diamétralement opposées. Malgré les arguments rationnels qu'elles font valoir, ni l'une ni l'autre, prise isolément, ne semble pouvoir donner une explication satisfaisante de tous les faits qui caractérisent l'épidémiologie de la méningite.

Considérant le méningocoque comme un germe ubiquitaire, au même titre que le pneumocoque, les partisans de l'autogenèse admettent qu'il végète à l'état saprophylique, soit dans le rhino-pharynx d'un grand nombre de personnes, soit dans les milieux extérieurs. Sa virulence et sa puissance de rayonnement se trouvent accidentellement exaltées, du fait de l'intervention, isolée ou simultanée, d'influences cosmiques, de la fatigùe, du surmenage, du refroidissement, etc. Peut-être y aurait-il également lieu d'accorder quelque action favorisant aux associations microbiennes susceptibles de se produire dans le rhino-pharynx, en raison de l'abondance et de la variété des germes qu'il renferme?

Mais, quelles qu'elles soient, les influences modificatrices invoquées relèvent toutes de causes d'ordre général, c'est à dire qu'elles sont représentées par des facteurs agissant en des endroits épars, disséminés, multiples, par suite sur un grand nombre d'individus. Etant donnée la prétendue ubiquité du germe, étant donnée la constance, je dirai presque la banalité des causes prédisposantes invoquées ou suspectées, il semble à priori, que si telle était la pathogénie, les manifestations de la méningite devraient être plus fréquentes et plus régulières dans leur apparition.

Cette conception cadre mal avec les caractères qu'ont présentés les derniers épisodes épidémiques; elle explique difficilement pourquoi, à la même époque, toutes les autres conditions étant les mêmes, on observait ici un cas isolé; là des groupements épars et peu denses; ailleurs, des foyers plus vastes avec tendance évidente à rayonner et à s'étendre; parfois même des localisations à un quartier d'une ville ou à une partie seulement de sa population (militaires, enfants, etc.).

Avec la théorie de l'autogenèse on éprouve de la peine à interpréter logiquement les oscillations qui se produisent dans le nombre des porteurs sains de méningocoques au cours des poussées épidémiques.

Il a été démontré, en effet, que la proportion de ces porteurs subit une marche parallèle à celle des cas avérés de méningite. L'évolution est identique dans les deux cas. Le nombre des porte-germes augmente pendant la période d'accroissement de l'épidémie, il atteint son fastigium lorsque celle-ci est à son acmé, puis décline progressivement à mesure qu'elle décroit.

D'après les autogénistes, la multiplication des porteurs de méningocoques devance et prépare la manifestation morbide; elle constitue en quelque sorte la phase préliminaire à laquelle succède ensuite l'épidémie. Pour employer leurs expressions, "les porte-germes préexistent à l'épidémie, ils la fomentent." Mais une question se présente de suite à l'esprit: Comment les porteurs sains sont-ils mis en possession du diplocoque spécifique? D'où le tirent-ils? Les partisans de l'autogenèse posent la question sans la résoudre. Essayons d'en donner une explication.

Si le méningocoque végétait antérieurement dans le rhino-pharynx des porte-germes, le nombre de ceux-ci devrait demeurer à peu près fixe; il ne subirait pas, en tout cas, les fluctuations si nettes, si régulières, que nous avons rappelées précédemment. En l'occurrence, on ne peut faire que deux hypothèses. La première consiste à supposer que des espèces microbiennes voisines du méningocoque peuvent se transformer graduellement dans nos cavités naturelles en méningocoque véritable. Ce que nous savons de la fixité des espèces en biologie ne permet pas de se rallier à cette manière de voir.

D'apparence plus plausible parce que plus conforme à la pathogénie de certaines infections, la seconde hypothèse porterait à admettre que le méningocoque provient de l'extérieur, du milieu ambiant. Mais, l'absence jusqu'ici constatée d'hôtes intermédiaires, rapproché de la vitalité éphémère de cet agent morbide en dehore de l'organisme vivant, rend bien invraisemblable son existence prolongée ailleurs que dans le corps humain. En sorte que tout compte fait, on se trouve finalement ramené à envisager l'homme sain, convalescent ou malade, comme origine et comme point de depart du méningocoque. Dès lors, qu'il soit apporté par les circumfusa ou les ingesta, comme le pensent les autogénistes, ou qu'il résulte de la transmission directe d'homme à homme, comme le prétendent leurs adversaires, on aboutit, somme toute, à la contagion indirecte dans le premier cas, immédiate dans le second.

La contagion de la méningite cérébro-spinale est de celle qui ne sauraient être niées. Trop de faits témoignent en sa faveur et attestent son existence. Il suffit de rappeler notamment:

(1) La transmission de la maladie aux personnes qui donnent leurs soins à des méningitiques. Des médecins, des infirmiers, des religieuses, ont été victimes de leur devoir professionnel.

(2) La succession de cas multiples dans une même famille, dans une maison, dans une chambre de caserne alors que les voisines restaient indemnes.

(3) La brusque apparition de la maladie dans une localité restée jusque là vierge de toute atteinte, à la suite de l'arrivée de personnes provenant de foyers contaminés, etc., etc.

Pour tout esprit impartial la contagiosité ne saurait faize de doute. Si l'on discute encore à son sujet, c'est plutôt sur son degré de fréquence, sur l'importance du rôle qui lui est dévolu.

Il est indéniable que la contagion n'apparaît pas aussi manifeste pour la méningite que pour les fièvres éruptives, la peste ou la diphtérie, par exemple. Mais cette différence, à notre avis, est plus apparente que réelle, car la prétendue rareté de la contagion de la méningite tient à ce fait qu'on lui attribue seulement les cas cliniques avérés, alors qu'en réalité il est juste de porter aussi à son actif les catarrhes du rhino-pharynx qui, bien que d'allure banale, relèvent du méningocoque, de même que l'augmentation croissante du nombre des porteurs sains que les recherches bactériologiques systématiquement entreprises au cours des dernières épidémies ont si bien mise en évidence.

En attendant quelqu'autre explication plus plausible, nous estimons que la constatation de la présence du diplocoque de Weichselbaum dans la gorge d'individus qui n'en étaient pas primitivement porteurs suffit à établir qu'il y a eu contagion. Il n'est pas indispensable, à notre avis, que la maladie confirmée s'en suive. Pour que celle-ci se déclare, il faut non seulement la graine mais encore un terrain favorable à son éclosion. La méningite est non seulement fonction de contagion, mais aussi de réceptivité.

Voilà pourquoi les anciens médecins qui ne disposaient pas du puissant appui de la bactériologie ont, quoique observateurs sagaces et avertis, méconnu la contagiosité, et si aujourd'hui quelques confrères la combattent encore, c'est parce que dédaigneux du laboratoire ils prétendent ne s'appuyer que sur la clinique.

Est-ce à dire que la contagion donne la clef de toute l'énigme, qu'elle suffise, à elle seule, à expliquer l'étiologie entière de la méningite?

Nous n'allons pas jusqu'à cette affirmation. Il est certains points qu'elle laisse obscurs; tels, par exemple, la génèse des cas isolés, dits sporadiques, qui se manifestent avec une apparence toute spontanée, de loin en loin, parfois à des intervalles fort éloignés, sans que les investigations les plus minutieuses permettent de saisir leur filiation, sans qu'on puisse les rattacher, dans le temps ou dans l'espace, à quelque cas antérieur, fut-il fruste, ou à quelque porteur de germes préexistant. Il en est de même des cas initiaux qui font souche et desquels procèdent les épidémies.

Pour les expliquer, nous nous rallions volontiers à la théorie de l'autogenèse de Kelsch, mais avec cette restriction toutefois de limiter son intervention à l'intérieur de nos cavités naturelles, car, dans l'état actuel de de la science son action ne parait pas applicable aux milieux extérieurs.

En d'autres termes nous pensons que le méningocoque, de même que le pneumocoque, peut se conserver dans le rhino-pharynx de certaines personnes, que sous l'influence de contingences diverses, sa virulence venant à s'exalter, il est à même de provoquer la méningite, soit chez ces mêmes individus lorsque leur réceptivité s'y prête, soit chez d'autres qui se sont contagionnés à leur contact. Nous appliquons donc à la méningite cérébro-spinale la théorie émise par Netter pour la pneumonie.

Voilà pour le développement des premiers cas. Quant à l'extension des épidémies nous estimons qu'elle relève de la contagion, c'est-à-dire de la dissémination du virus par transit interhumain, en partant des malades en période d'état ou d'incubation, des convalescents ou des porteurs sains.

Parce qu'il est avéré que ces derniers contractent rarement la méningite, il ne s'ensuit point qu'ils ne soient pas dangereux pour autrui. Ce sont peut-être les plus redoutables, parce qu'étant habituellement méconnus on ne s'en méfie pas et on ne prend aucune précaution a leur égard. Les faits ne manquent pas qui plaident en faveur du rôle contagionnant que nous leur prêtons. Ici, ce sont des médecins approchant des méningitiques qui voient survenir dans leur propre famille des cas de cette affection, alors que les victimes n'ont pas été exposées par ailleurs à d'autres contacts suspects que le leur. N'est-il pas naturel, surtout quant l'ensemencement décèle par la culture l'existence du méningocoque dans le mucus naso-buccal de ce médecin demeuré valide, d'admettre que le virus a été transporté par lui. Là, c'est un militaire bien portant qui quitte sa garnison absolument indemne pour aller assister aux obsèques d'un parent mort de méningite et qui, quelques jours après sa rentrée, tombe frappé à son tour sans avoir eu de contact avec le malade.

Netter rapporte qu'à Schlestadt, Mistler avait remarqué que les premiers cas observés dans la population civile étaient survenus chez les enfants d'un cabaretier dont l'établissement était fréquenté par les soldats d'un régiment contaminé et chez ceux du-boucher qui fournissait la viande à la caserne. Il y a là plus qu'une simple coincidence.

Dans la communication du Médecin Inspecteur Général Vaillard les faits sont plus probants encore, puisqu'on a pu suivre les cas au fur et à mesure des déplacements des porteurs de germes décelés par l'expertise bactériologique.

En résumé, la théorie de l'autogénèse et celle de la contagion nous semblent trop absolues dans leurs décisions, et nous concluons en disant qu'au lieu de s'exclure l'une l'autre, elles doivent se prêter un mutuel appui et se compléter.

Cette conclusion n'offre pas seulement un interêt doctrinal, elle est surtout importante au point de vue pratique. Si l'on refuse à la contagion le rôle prépondérant que nous réclamons pour elle, dans la propagation des épidémies il n'est plus de prophylaxie possible. Les influences météoriques que l'on invoque pour donner au méningocoque la virulence nécessaire sont au dessus de nos forces et de nos moyens d'action. Si la principale responsabilité leur incombe nous n'avons plus qu'à nous incliner devant les événements et à les subir. Or, cette attitude ne saurait convenir aux médecins qui ont charge de la santé des collectivités. C'est pourquoi il nous a paru opportun de revenir à nouveau sur la question si controversée de l'étiologie de la méningite d'où dépend sa prophylaxie.

DISCUSSION.

Dr. W. Ed. Grant: I had the misfortune last winter to have under my care, as health officer of the city of Louisville, Ky., an epidemic of cerebrospinal meningitis. We at once established a temporary hospital for the treatment of all cases. From the first we relied impartially upon the Flexner serum, which was furnished ad libitum by the city health department, and found it of the highest value in nearly every case which received prompt treatment. We had, in all, 200 cases, with a death rate of about 40 per cent, but if we eliminate the cases brought to the hospital which died within the first 24 hours our death rate was less than 12 per cent.

We saw four cases in one family, and in several instances two cases in one family. The disease did not seem to be easily acquired by contact, as none of the employees about the hospital were taken with it. The outbreaks occurred in all parts of the city, but in a very large majority, cases were in families living in very bad hygienic surroundings. I am greatly interested in the case of carriers of

this disease and measures for quarantine, as I greatly fear a return of the epidemic to my city during the coming winter.

Dr. WILLIAM H. PARK: The subject of cerebrospinal meningitis has been constantly under investigation in the laboratories of the department of health since the epidemic of 1905. In spite of the brilliant results obtained from the use of the serum, the disease has still a high mortality. We should use every means to check its spread. The results of the studies of Drs. Bolduan and Goodwin showed that 15 per cent of the cases gave a history of contact infection, and that many attendants were carriers of the meningococci in their nasal cavities. Apparently, only a small proportion of those so infected became afflicted with meningitis.

THE CONTROL OF RABIES.

Prof. HENRY ALBERT, University of Iowa, Iowa City, Iowa.

BRIEF HISTORICAL NOTE.

Although reference is made to a disease in dogs which was no doubt rabies, by Aristotle, as long ago as the fourth century before the Christian era, and distinct epidemics of the disease were recognized as far back as the beginning of the seventeenth century, it was not until about 1875 that it was demonstrated that the disease could be markedly limited in its spread and probably entirely stamped out. Accordingly, at about that time several nations adopted rigid regulations for the control of the disease. Such nations have been abundantly rewarded; the disease no longer existing in Great Britain, Norway, Sweden, and Denmark. With such a remarkable demonstration of the efficacy of a preventive measure, it seems indeed strange that most of our civilized nations have not yet adopted measures which if carried out may be relied upon to exterminate the disease. This in face of the fact that, taken the world over, the disease is apparently on the increase.

PREVALENCE OF RABIES IN THE WORLD AT THE PRESENT TIME.

Rabies is a very widespread disease. With the exception of Australia, there is not a continent that is free from it. It is apparently most prevalent in the countries of Europe adjacent to the Mediterranean Sea. On account of the fact that in most countries the disease is not reportable, except as it causes the death of a person, it is impossible to obtain even fairly accurate data as to the number of cases of rabies now in existence. The figures presented in the following table give, therefore, only an approximate idea as to the number of persons who are annually bitten by rabid or presumably rabid animals:

TABLE NO. 1.—*Number of persons bitten by rabid or persumably rabid animals in various countries.*

Country.	Number.	Year.	As determined by the number of persons who received the Pasteur antirabic treatment at—
Argentina	417	Average of past 24 years	Buenos Aires.
Australia	(a)		
Austria	452	Average of 1907 and 1908	Vienna.
Brazil	583	1911	Sao Paulo.
Bulgaria	1,027	1911	
Canada	(b)		
Denmark	0	For past 50 years	
France	467	1909	Paris.
Germany	374	1909	Berlin and Breslau.
Great Britain	0	Since 1902	
Hungary	806	Average 1890–1908	Budapest.
Holland	(b)	Since 1879, except along the Belgian border.	
India	2,073	1910	Kasauli.
Italy	3,537	1909	Rome, Milan, and Turin.
Philippine Islands	54	Year ending June 30 1911	Manila.
Portugal	1,672	1911	Lisbon.
Russia	3,520	1909	St. Petersburg and Charkaw.
Spain	649	1911	Madrid and other places.
Sweden	0	Since 1870	
Switzerland	0	1911	
Turkey	978	1908	Constantinople.
United States	4,625	1911	

[a] Never introduced. [b] Few cases.

PREVALENCE OF RABIES IN THE UNITED STATES.

In 1900 Salmon[1] reported that there had been 230 deaths of human beings from rabies in 73 of the principal cities of the United States, from 1890 to 1899.

According to the mortality statistics of the Bureau of the Census, the number of deaths of human beings from rabies in the registration area of the United States was 33 in 1900, the number gradually increasing to 85 in 1906, and falling to 75 in 1907.

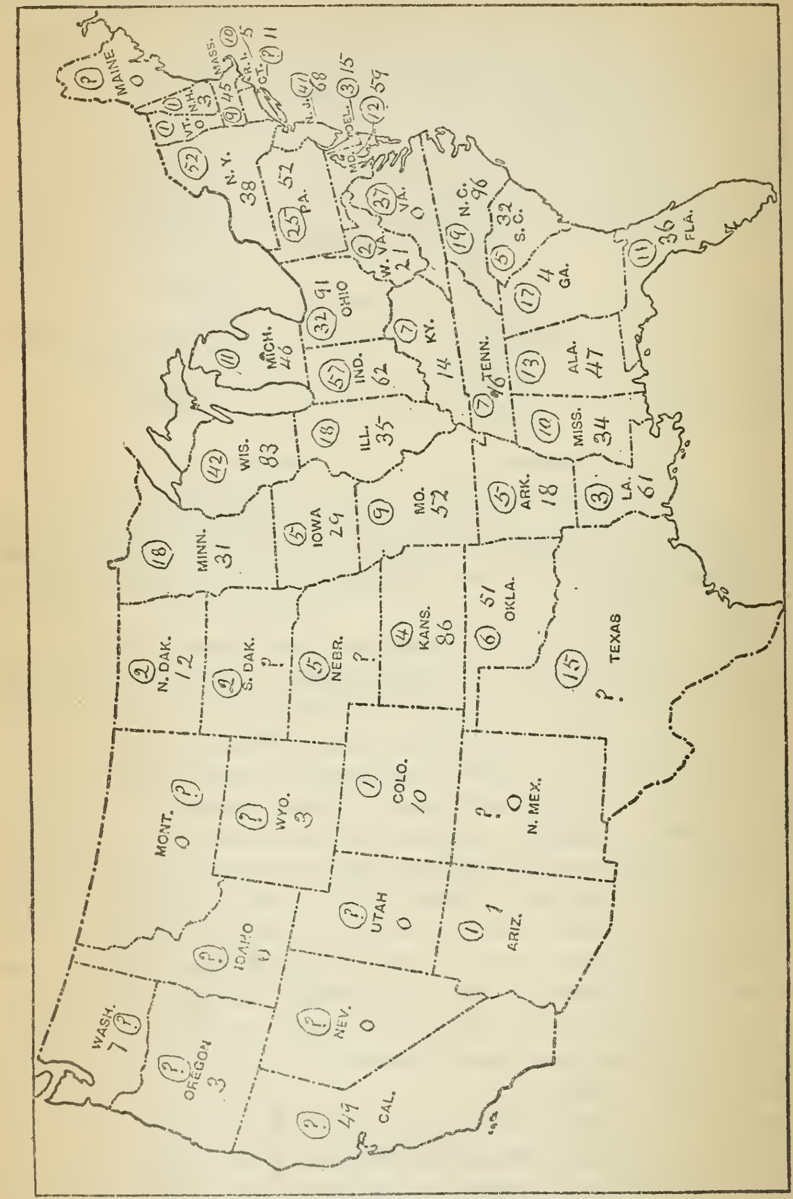
The Public Health and Marine-Hospital Service made an exhaustive study[2] into the prevalence of the disease in the United States in 1908. According to their findings, rabies was present in 534 localities distributed throughout the United States, with the exception of 10 States; there occurred 111 deaths of human beings, and about 1,500 persons received the Pasteur antirabic treatment.

During the past few months, I have collected data relative to the prevalence of the disease in the United States during the year 1911. Data were also collected by the Public Health and Marine-Hospital Service.[3] Such data have been combined in the form of the charts shown on pages 76 and 77.

A comparison of the distribution of rabies in the United States in 1908 and 1911 indicates that during the last three years:

1. There has been an increase of rabies in the United States, as indicated by the fact that during 1908 there were 534 infected localities, and about 1,500 persons received the Pasteur antirabic treatment, whereas, in 1911, there were 1,381 infected localities, and 4,625 persons received the treatment.

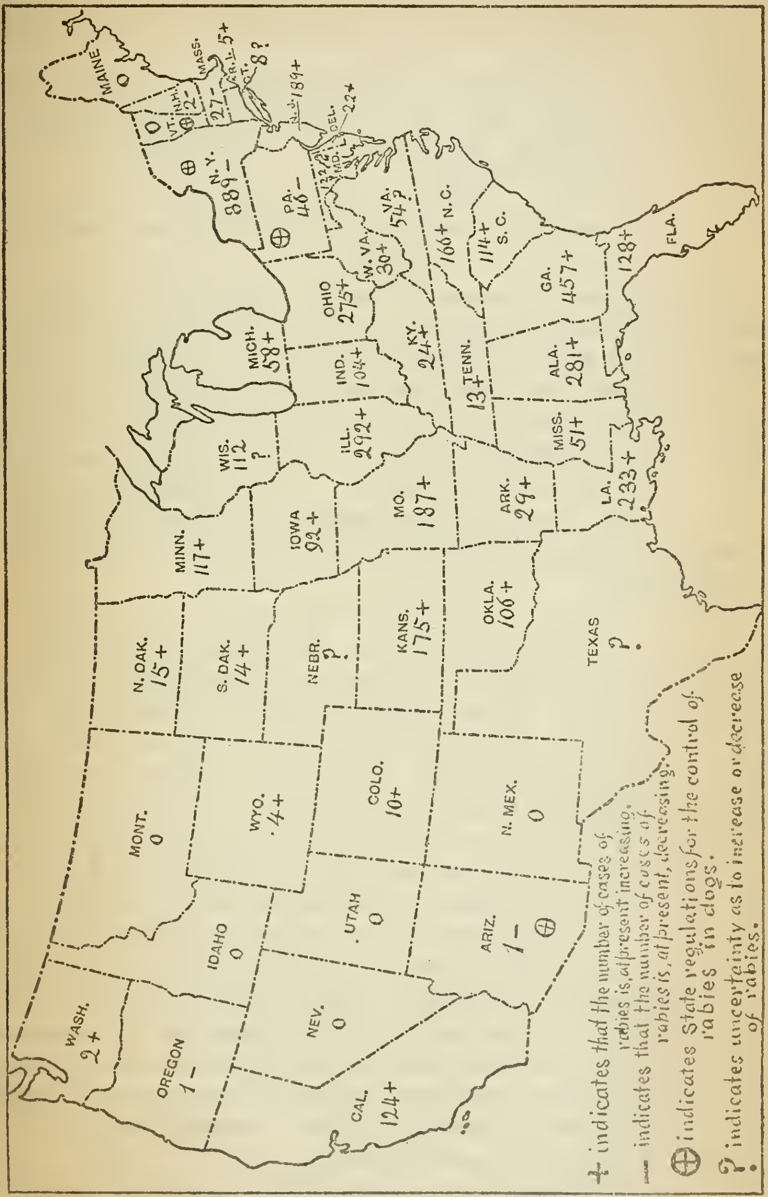
2. The increase has occurred principally in the southern and middle western states, very few of which have any enforced regulations concerning the muzzling and movement of dogs.



RABIES IN 1908.

3. There has been a decrease in the number of cases in most of the New England States where, since the epidemic of rabies several years ago, regulations aiming at the control of the disease in dogs have

been rather rigidly enforced. In Rhode Island the relaxation in the enforcement of muzzling regulations during the past two years is causing a distinct increase in the number of cases.



RABIES IN 1911.

4. The disease is somewhat on the increase in the far West, more especially in California. It is believed by some that the spread of rabies in Arizona is due principally to the bite of skunks. With the

object of controlling the disease a bounty is being paid for skunks in that State. The secretary of the State Board of Health of Montana informed me that, so far as known, there has never been a case of rabies within its borders. It would be unfortunate if the disease should gain a foothold among the wild animals of the West, as it has done in some countries.

It is well understood that infection with rabies takes place almost only through a wound, such as the bite of an animal, and that, although any of the warm-blooded animals may be affected, the dog is by far the principal offender.

METHODS WHICH MAY BE EMPLOYED FOR THE CONTROL OR ERADICATION OF RABIES.

I. *Immediate local treatment.*—The development of the disease can be largely prevented by treatment of the wound with some caustic, preferably nitric acid. Cauterization should, of course, be done as soon as possible after the wound is inflicted. Experiments performed in the research laboratory of the New York City Department of Health indicate that the application of nitric acid is of value, even if such application be delayed for 24 hours. Dr. Park believes that "in the case of small wounds, all the treatment probably indicated will be thorough cauterization with nitric acid within 12 hours from the time of infection."

II. *Pasteur antirabic treatment.*—The Pasteur treatment has largely robbed rabies of its terrors. Previous to 1886, when the treatment was first begun at the Pasteur Institute in Paris, the mortality from rabies of persons bitten by rabid or presumably rabid animals was 16 per cent (Leblanc). Since that time more than 30,000 persons have received the preventive treatment at that institute, with a mortality of only 0.5 of 1 per cent. The Pasteur treatment is given in most of the countries of the globe and, through the Public Health Service, is made available in every State of the United States. The results at other institutes have been practically the same as those of the institute at Paris. However efficient this treatment has been in preventing the development of the disease in infected individuals, it is probable that the safety assured by the treatment has caused a relaxation in the enforcement of regulations aiming at the control of the disease in dogs and other lower animals. Dr. T. Murillo recently informed me that he believes that, for the reason mentioned, there are more cases of rabies in Spain at the present time than there were 20 years ago.

III. *Accurate diagnosis.*—In practically all countries the clinical diagnosis is confirmed whenever possible by a laboratory examination, consisting of a search for Negri bodies or of an animal inoculation, or both. The great mistake that is often made is the killing of the animal as soon as rabies is suspected. If the animals are detained and watched for the development of the disease instead of being killed, it will be found that some of the Pasteur treatment, which is now being given, is unnecessary, but at the present time advisedly administered.

IV. *Regulations aiming at the control of rabies in dogs and other lower animals.*—Although rabies may be transmitted by the bite of any of the warm-blooded animals, the disease is propagated principally by dogs. For that reason regulations aiming at the eradication of the disease, with but occasional exceptions, must be aimed at dogs. The enforcement of the following measures may be relied upon to cause the extermination of rabies:

1. *Licensing.*—Stray, ownerless dogs are the principal offenders, not only in spreading rabies, but in doing harm to live stock. Irrespective of the presence of rabies in a community, all dogs ought to be licensed and provided with a collar and license tax and all stray dogs destroyed in a humane manner. The expense of enforcing such a license rule may be maintained by the dog-license fees. The rule has been enforced in England and in the other countries from which rabies has been eradicated. The present decline of the disease in Paris is attributed by Dr. Letulle to the strict enforcement of the regulations regarding the capture of stray dogs.

2. *Muzzling.*—Wherever rabies is present in a given place, all dogs permitted to run at large should be muzzled and kept muzzled for a period of at least six months after the disappearance of the last case from the locality. There is a difference of opinion as to the size of the territory in which dogs should be muzzled whenever the disease appears. Certainly it should not be less than a city of moderate size, or in rural communities it should, in the United States, not be less than an average-sized township. If several cases occur at places several miles apart, it is advisable to have the regulations enforced over an area corresponding to a county. If the disease is quite widespread, it is certainly best to have the dogs of an entire State muzzled. The muzzling of dogs is the most important measure in preventing the spread of rabies in a community where the disease exists. In the larger cities of Germany dogs permitted to run at large are always muzzled. The objection to muzzling comes from many well-meaning people who believe that it is cruel. It is not cruel to place a properly constructed (such as the basket type, made of metal) and properly fitting muzzle on a dog. Such a muzzle will permit the dog to open its mouth, pant, and drink, but not to bite. It is no more cruel to put a muzzle on a dog than a bit in a horse's mouth. Of course the dog will resent it at first; so does the horse resent the bit. But once they become accustomed to it, they do not mind it. The good effect of this procedure has been demonstrated many times and in many places. Probably the best example is the result brought about in England.

With the enforcement of the muzzling law, the number of cases of rabies rapidly declined from 217, in 1887, to 38, in 1892. In 1892 the authorities yielded to the petition of "dog lovers," and permitted muzzling to be discontinued. As a result the disease rapidly increased in number, so rapidly that during the third year (1895) 672 dogs and 20 human beings died from rabies. The muzzling law was again enforced, the number of cases rapidly decreased, and, in 1902, entirely disappeared. Since that time no case of rabies has been recognized in Great Britain. Dogs are not muzzled in England at the present time, but we are informed that muzzling will be resumed with the appearance of a single new case of the disease. The existence of a muzzling act should require all dogs not muzzled to be killed by the proper health or police authorities. In some places the right to kill any unmuzzled dog is given to any person. If the law held the owner of a dog legally responsible for all damage done by such, muzzling could be enforced much more readily than is the case at present.

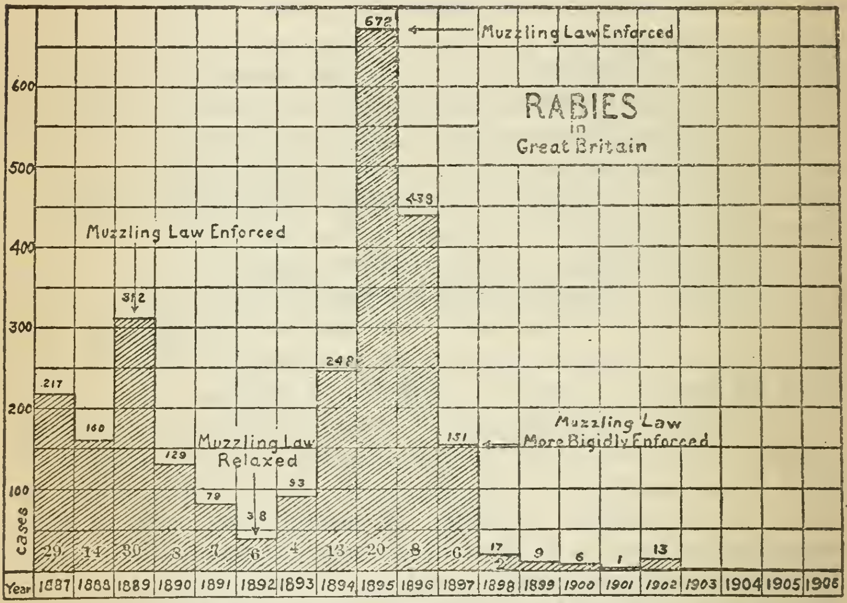


Chart showing relation of enforcement of muzzling law to prevalence of rabies in Great Britain. The figures in the cross-hatching indicate the number of persons who died of rabies in England. Credit for making this chart is largely due to Mr. Aubrey H. Strauss.

3. *Detention of dogs.*—Dogs that have been associated with rabid animals, and are therefore probably infected, should be confined to a kennel or shed for a period of not less than three months, and preferably six months. When taken out for exercise, they should be muzzled and led in leash. When the disease is very prevalent, it is best

to have all dogs confined. Females in heat should at no time be permitted to run at large.

4. *Destruction of dogs.*—All dogs known to be affected by rabies or to have been bitten by rabid animals should certainly be killed. The great mistake that is usually made is to kill an animal immediately after that animal has bitten a person, on the suspicion that it may be affected by rabies. The importance of such an error is realized when we remember that it is not always possible to get laboratory evidence of the disease, even when it exists. Whenever possible an animal that has bitten a person should be kept confined for a period of 10 days. If the disease does not develop nor the animal die within that time, it may be safely concluded that rabies does not exist.

5. *Quarantine.*—To prevent the introduction of rabies into a country, all dogs that are imported should be held in quarantine for a period of six months. Australia owes to a rigid enforcement of such a law the fact that it has never had a case of rabies. England, likewise, depends on it to keep the country free from the disease. Such quarantine may likewise be applied to the smaller divisions of a country. During a recent outbreak of the disease in Canada it was prohibited to move dogs from the infested area. In Germany a certificate from an official veterinarian is necessary to have a dog moved from one section to another. The federal government might impose a quarantine against a given state, should the disease become very prevalent within its borders.

There are few diseases that can be so easily eradicated as rabies. We have now the knowledge necessary to secure its disappearance. All that we need is action on the part of our authorities, which, to be effectual, must, of course, have the cooperation of the general public. The time is now ripe for organized effort to stamp out the disease. It has been done in England, and can likewise be done in other insular territories. It has been accomplished in Norway, Sweden, and Denmark, and can likewise be done in other peninsular regions. It is more difficult to rid of rabies, inland countries with extensive land boundaries. Even in these much can be accomplished, as has been demonstrated by Germany, Holland, Canada, and some of the eastern states of the United States. It is hardly to be expected, however, that the disease will be entirely eradicated without cooperative, or at least simultaneous, action on the part of adjoining states or countries. In the United States the question of state rights requires that the efforts be left largely with the individual states. If every state in which the disease exists would take as vigorous steps to exterminate rabies as were taken in England, and if like action were taken by the countries to the south of us, as has substantially already been done by Canada on the north, it would be possible to remove the last vestige of the disease from the North

American Continent in the course of a few years. In like manner the disease could be eradicated from other continents.

To exterminate rabies it is necessary that the general public should be better informed than it is at present regarding the disease. The people should be made to realize especially:

That rabies is prevalent in most countries the world over, and that in many places—more especially in parts of the United States—it is distinctly on the increase.

That it is possible to exterminate the disease in the course of a few years by the adoption of easily executed regulations concerning dogs.

That, in particular, the muzzling of dogs is not a hardship to the animal, and that from a sanitary and economic point of view it is advisable to get rid of all stray or ownerless dogs.

That the eradication of rabies is worth while for economic reasons, because of the loss to the live-stock industry.

That efforts at its eradication are many times over justified by the loss of human life, and the almost endless amount of worry which is now attached to the bite of a dog.

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[1] Salmon, D. E., Year-Book Dept. Agri., 1900.

[2] Kerr and Stimson: Jour. Amer. Med. Assoc., Sept. 25, 1909, Vol. LIII, p. 989.

[3] Stimson. Public Health Reports, Vol. XXVII, No. 28, July 12, 1912.

DISCUSSION.

Dr. Eduardo Liceaga: For the last 24 years the Pasteur treatment has been used by me in Mexico, without the slightest modification, as I myself learned it from the Pasteur Institute. Out of 8,000 inoculations, no rabies took place.

Dr. Julius Rosenstirn: I believe one of the first requirements for fighting the spread of rabies is the education of the officials—of those who make the laws and ordinances that order loose running dogs to be muzzled. We in San Francisco had for the first time in the history of our city some few cases of rabies last year. They came from southern California, where they had been imported by eastern visitors, and created quite an epidemic in Los Angeles. Our excellent mayor is an ardent lover of dogs, so are some of the supervisors, and they considered it a cruelty to compel dogs to be muzzled. They thought this the more so, as their belief in the Negri bodies, and even in the existence of rabies as a distinct disease caused by infection from the bite of a mad animal, leaned decidedly to the negative side. I had been called upon by the chairman of the health committee of our board of supervisors, fortunately a highly intelligent physician, to help him in his fight for the muzzle ordinance. I assure you it was pretty hard work to finally succeed. I would also like to ask Dr. Albert about those experiments which, according to his paper, have proved a sufficient curative power of the acid cautery if applied within a reasonable time after the injury—say, up to 24 hours. Are those experiments made on street-infected animals—that is, on animals bitten by a mad animal—or on laboratory infected animals? With the latter we know the amount of virus introduced; with the former, never. Although we know of the slow action of the Negri bodies, judging from the experiments made by rubbing cultures of strepto and staphylococous on rat tails with superficial fresh excoriation, and their quick entrance, after an interval of a few minutes only, into the general circulation, we should doubt that it would take hours for the Negri bodies to do the same thing. I must confess I consider it an unwise thing to teach that a cautery, which we know acts by coagulation, and by this very action accomplishes only a surface destruction of germs, may be all that is required for rabies-infected wounds. I shall always consider it my duty to insist that while cauterization is a very estimable thing for preliminary treatment, it should in any and all cases of rabies-infected wounds be followed up with the Pasteur treatment.

Dr. Henry Albert: In answer to the question as to the tests regarding the efficacy of the cauterization of the local wound, I will say that the tests which I referred to in my paper were made in the Research Laboratory of the New York City Board of Health. The tests were made on guinea pigs. No one would, however, depend entirely on the local treatment. It should, however, be used in all instances, because of its great effectiveness, and also because the Pasteur treatment occasionally fails to produce the proper immunity.

RABIES (HYDROPHOBIA); ITS NATURE AND TREATMENT.

James Gordon Cumming, M. D., in charge of the Pasteur Institute of the University of Michigan, Ann Arbor.

In considering rabies, or hydrophobia, one naturally asks in what manner is this disease introduced into a region where there is no previous record of its existence, how controlled after its introduction, and finally how eradicated. It is not of spontaneous origin, and we can say that the incubation period is seldom more than six months. The virus can not lie dormant for years, as is a common fallacy, then suddenly cause a veritable epidemic. There is no record of rabies in the Dakotas prior to 1906. During that year, from the neighboring State of Minnesota, there is an authentic record of its introduction. At first the disease was not recognized; as a result an epidemic of considerable proportions developed. During the year 1911 California had its first epidemic of rabies. For several years previous to that date the disease had existed only in the sporadic form and in a limited area. Its extension from this limited focus in the year 1911 resulted in an epidemic which finally involved the entire southern part of the State.

This disease is commonly introduced into new territories by rabid dogs—or, in some instances, by wolves or foxes—which, during the rabid stage, have traveled many miles. For instance, a rabid dog, identified by its license tag as belonging in Ann Arbor, was killed in a small town 15 miles distant the next day after it was missed from home. Likewise, a rabid dog belonging in Bay City was found 45 miles distant, having been away only two days.

The disease, during the incubation stage, may be conveyed also through the transportation of dogs over railroads or by automobiles. For example, during the fall of 1907, rabies was epidemic in Hamilton, Ontario. The pet dog of a tourist who had stopped at that place was bitten by a strange dog. After a three weeks' tour the owner of the dog made a two days' stay at Kalamazoo, Mich. While in that place the dog developed a vicious, quarrelsome nature, and bit a number of dogs. The animal was finally tied, and after its death laboratory examination proved it rabid. As a result of this transported strain of virus from Hamilton, some 300 miles, Kalamazoo suffered an epidemic of rabies. In the summer of 1908 a dog which had a week previous been brought to Ann Arbor from the infected district of Grand Rapids developed rabies. It was ascertained that the dog had been bitten five weeks before it was transported. The disease in the early stage was not recognized by the owner, so naturally the animal had its freedom, and as a consequence a number of dogs in this new territory were infected. The dog was proved by laboratory examination to have been mad, and an order was issued by the city council to the effect that dogs known to have been bitten should be dispatched and that all other dogs must be muzzled. As a result of this order four dogs were dispatched; eventually two others developed rabies, but being securely confined they did not act as spreaders of the disease. In this instance the virus passed through but one generation after its introduction into this new locality. If the disease is immediately recognized upon its entrance into a territory and there is an enforcement of the dispatching and muzzling laws the virus may be limited, as in this case, to a single generation, or at most to two generations. In certain well-governed countries, such as England and Australia, rabies is unknown. In these countries the importation of the disease is prevented by a six months' quarantine to which every dog upon entering the country is subjected. In these two countries it is unnecessary to muzzle dogs as a preventive measure in controlling rabies. On the other hand, the efficiency of the universal muzzling law is well shown in the experience of Germany. That country averaged 500 rabid dogs a year prior to the rigid enforcement of the law requiring all dogs to be muzzled or led. Since the enactment of this law the disease has become practically extinct. Unlike these countries the United States has neither interstate nor Federal quarantine against rabies; moreover, a muzzling law is enforced only in time of local epidemics.

Incidentally, the question as to the proper muzzle to be used is seldom considered; without defining the kind, the decree is issued that all dogs must be muzzled. As a matter of fact, the ordinary muzzle is useless in serving the purpose for which it is intended. I refer to the common strap muzzle. To serve its purpose—preventing the animal's biting—such an apparatus must fit so tightly that the dog can neither eat nor drink without its removal. Furthermore, it is impossible for the animal wearing a properly fitting strap muzzle to perspire; if it is loose enough for him to perspire, it permits him also to bite.

In infected localities, there is only one method of eradicating rabies in a humane and efficient manner. This is by the use of the wire muzzle. Such a muzzle permits the dog not only to perspire normally, but also to eat and drink without its removal.

In districts where the disease prevails, either in the sporadic or epidemic form, all dogs should be properly muzzled or led, and, if not, they should be dispatched by the police. Also, all ownerless dogs should be dispatched, and the keeping of useless dogs should be discouraged by high taxation. The transportation of dogs from infected localities should be prohibited, or the dog should be kept in quarantine for six months. Finally, however, if all dogs in the United States were properly muzzled for one year this disease would be practically eradicated.

Turning our attention from street virus to laboratory work on fixed virus, we find that much has been accomplished since 1880. Up to that time the only method of treating a wound made by a rabid animal was that of cauterization. The only value of cauterization is to diminish the amount of the virus, or to destroy it entirely. When used alone, however, this precautionary measure is unreliable, owing to the fact that it may not destroy all the virus. The work of Pasteur supplied the necessary complement to cauterization. In the institute of Pasteur, during the first five years, there was a mortality of only seven-tenths of 1 per cent; whereas, among those untreated during the same five years, the official records show a mortality of 20 per cent. At the present time the mortality among patients receiving the Pasteur treatment is from one-tenth to three-tenths of 1 per cent.

This low mortality, as compared to the original death rate of about 1 per cent among those treated, may be due to modifications in procedure. For instance, we have found that it is useless to use emulsions made from spinal cords which are more than 10 days old. Cords older than this have low immunizing power; on the other hand, it is not advisable to make use of emulsions made from cords which are less than 4 days old. A standard suspension of a 3-day cord when injected intracranially often causes the disease. In an adult human subject, however, the danger from infection from a 3-day cord is extremely small, and even this exists only when by chance the needle damages a large subcutaneous or intramuscular nerve trunk. As young animals are more susceptible to infection than mature ones, it would seem reasonable to assume that in children the use of a 3-day cord is not without risk.

As can be shown, the degree of immunity does not depend upon the actively virulent suspensions; owing to this fact, and to the danger accompanying their use, they should be eliminated from the treatment. It is impossible to immunize animals by subcutaneous injections of 4, 3, and 2 day desiccated cords; animals so treated invariably die from rabies. Furthermore, animals which have received the intensive form of Pasteur treatment often die as a result of a subcutaneous injection of a 1-day cord; an intracranial injection of this suspension invariably kills, although the incubation period may be somewhat prolonged. In untreated animals, intracranial injection from cords desiccated up to 4 days almost always kill. By using suspensions made from 10 to 4 day cords, the immunity is greater than when older cords are used. The latter should be eliminated, and those desiccated less than 4 days should be done away with, owing to the possible danger of infecting the patient.

Another modification of the Pasteur treatment is based on the supposition that high dilutions of fresh fixed virus can be injected without danger to the patient. In this, the Högyes or Budapest method, the first treatment consists of a subcutaneous injection of a one to ten thousandth suspension of fresh rabic brain in physiological salt solution. With each successive treatment lower dilutions are used, the last being a suspension of 1 to 100. An intracranial injection of any one of these suspensions will cause the disease in animals, and the immunity conferred protects against but one and one-half times the minimum fatal dose somewhat less than by the original method of Pasteur.

A modification of the above method, as used by some workers, consists in the use of freshly prepared virus—presumably 1 to 100—a method which is positively dangerous. The experience of thus inoculating the patient is demonstrated by Breggi. Attempts to produce immunity in rabbits and guinea pigs in this manner in our laboratory resulted in infection from the treatment itself. In numerous sets of 5 and 7 animals so treated, infection resulted in 2 or more animals; at times, even, all the animals in a given set died.

Aside from desiccation and high dilution, we find, in a brief summary of our work, that rabic virus may be destroyed in a 1 per cent suspension as follows: The thermal death point is comparatively low. It is destroyed in 20 minutes at an exposure of 45° C., in 15 minutes at 50°, in 5 minutes at 60°, and in less than 2 minutes at 100° C. Exposure to carbon dioxide destroys it in about 24 hours. A 2 per cent solution of carbolic acid destroys the virus in 30 hours and a 2 per cent solution of sodium chloride has a similar effect. This destruction is due to the nonisotonic condition of the suspension, and can hardly be considered as a disinfectant action. A five-tenths per cent carbolic acid in physiological salt solution may be used for the purpose of preserving the virulence of rabic brain tissue. On the other hand, aldehyd compounds are extremely active in destroying the virus. A five-tenths per cent solution of aceticaldehyd kills it in five hours. The specific disinfectant action of formaldehyd is shown by the fact that the virulence is lost when exposed for 2 hours to a one-tenth per cent solution. As a result of this work, we advise, as a preliminary measure, the disinfection of wounds made by animals with undiluted formalin. By the collodion sac method, it was demonstrated that the virus is destroyed in the peritoneal cavity in three hours. When a 1 to 20 rabic brain suspension in physiological salt solution is filtered through a Berkfeld filter by 26 inches of mercury, one twenty-fifth of the original virus in suspension is found in the filtrate. When inoculated intracranially the filtrate is virulent up to a dilution of 1 to 1,000.

In considering the normal habitat of the virus, it is generally conceded that the mortality from inoculation depends upon the avenue of injection.

In our work we found that intravenous injection of the standard suspension caused death in only about 10 per cent of the inoculated animals. Intraperitoneal inoculation, on the other hand, gives a mortality of about 20 per cent. The death rate among animals injected by the intramuscular route is about 85 per cent; while by the intracranial method it is 100 per cent. From these percentages it is evident that the virus must have a suitable medium in which to reproduce itself. This is found in the nervous system, because it is not exposed to the rapid interchange of the body fluids. Consequently, when the virulent virus gains access to the nerve trunks it is protected from the destructive action of the body fluids, and here it finds a suitable medium, where it readily extends its invasion.

The antagonistic action of the blood and lymph contributes a favorable influence in reducing the mortality from hydrophobia. We can reasonably assume that the bite of a rabid animal invariably results in the implantation of a varying quantity of the virus. The virus must come in direct contact with the broken nerve fiber in order to reproduce itself and to extend along the nerve trunk to the spinal cord and to the brain. As long as it is limited to the peripheral nerves it can not reproduce itself in sufficient quantities to cause symptoms of the disease. Upon its entrance, however, to the spinal cord and brain there is presented an extensive trunk system through which it readily spreads, and in which the virus reproduces itself in such quantities as to cause the characteristic symptoms and, finally, a fatal termination.

The foregoing statements must not be construed as meaning that, even after a lapse of three days, cauterization is valueless. The virus which is not in direct continuity with the broken nerve trunk will be destroyed by the lymph and blood serum; moreover, owing to the slow progress of the virus, a reopening and thorough scrubbing of the wound, followed by cauterization with full strength formalin or with fuming nitric acid—even after a lapse of three days—will be of great value in reducing the quantity of infecting virus.

The Pasteur treatment protects against twice the minimum fatal dose of fixed virus injected by the intracranial method. Hence the immunity produced by the Pasteur treatment may be expected to protect against an amount of street virus subcutaneously introduced equal to twice the minimum fatal dose of the fixed virus injected intracranially. We would then say that a case is hopeless in which the amount of infecting street virus is equal to three times the minimum fatal does of fixed virus. The vital preliminary to the vaccine treatment is the proper cauterization of the wound. If, by this measure, even one-third of the infecting virus be destroyed, the subsequent preventive injections may protect against the remaining two-thirds. The value of cauterization with full strength formalin, especially in face bites and lacerating ones on other parts of the body, cannot be overestimated. This, followed by the vaccine treatment, should reduce the mortality from hydrophobia to zero.

An improved method of antirabic treatment has been devised and perfected in our laboratory. It consists in dialyzing the standard suspension of rabic brain tissue against running distilled water until the active virulent virus is destroyed, which destruction can be shown only by the intracranial method of injection. Subcutaneous injections cannot be depended upon to demonstrate the destruction of the virus. The time required to destroy the infectivity of the virus depends upon the rate of dialysis; the thickness of the dialyzing membrane; the density and the amount of the suspension; the rate of flow of the distilled water, and the temperature. Under proper condition, the virus is destroyed in from 12 to 24 hours. An intracranial injection of such a suspension does not produce the disease; therefore subcutaneous injections of the dialyzed suspension thus prepared are not only perfectly safe as a prophylactic measure, but, as will be shown, they confer the highest degree of immunity. It is possible to reproduce rabies in animals by an intracranial injection of a suspension made from a 7-day desiccated cord; by this new method of preparing the vaccine, however, it is impossible to produce the disease in animals even by intracranial injections, thus absolutely eliminating all danger of infecting the patient; while, at the same time, this method confers the highest degree of immunity that can safely be obtained. A series of 12 successive daily injections of the standard dialyzed suspension gives the same degree of immunity as is obtained by the intensive form of the Pasteur treatment, which consists of 21 daily injections. By increasing the number of injections of the dialyzed suspensions, the immunity is increased proportionally. Not only does one obtain a higher degree of protection by this method, but the immunity is produced at an earlier stage in the course of the treatment than by the other methods. This fact is of especial value, not only in the treatment of severe bites, particularly those on the face, but also in those cases which do not report for treatment earlier than two weeks after having been bitten.

In estimating the relative value of this and older methods of antirabic treatment the following experiment may be cited: Three series of seven animals each were immunized as follows: The first set by the Pasteur method, the second by that of Högyes, and the third by the dialyzing method. Two weeks after the completion of the treatment these three sets, together with a control set, were injected by the intracranial method with known amounts of fresh fixed virus. The minimum fatal dose by this method of injection is 0.02 milligram (0.5 cubic centimeter of a 1:25,000 suspension). The animals in each set, including the control set, received, respectively, the following amounts of fixed virus: 0.02 milligram, 0.023 milligram, 0.027 milligram, 0.033 milligram, 0.041 milligram, 0.05 milligram, 0.06 milligram. Each animal in the series received a larger dose than the preceding one, the last receiving three times the minimum fatal dose. The results were as follows: All the animals in the control set died; in the Pasteurized set the last three, which received the larger doses, succumbed to the disease, whereas the first four showed no symptoms; in the set treated by the Högyes method the last four in the series died, while the other three were protected; in the series treated by the dialyzed method even the last animal did not become infected.

Some animals are protected against as much as 10 times the fatal dose by the dialyzed vaccine.

By this method of testing the efficiency of the antirabic treatment we find that the original Pasteur treatment confers a protection against but twice the minimum fatal dose, and that by the Högyes method against only one and one-half times the minimum fatal dose; whereas by the dialyzed method the immunity acquired protects against at least three times the minimum fatal dose. These results represent the average immunity obtained in a number of sets of animals immunized by each of the three methods. Nine sets were subjected to the Pasteur treatment, 6 to that of Högyes, and 24 sets were tested by the new method.

The results of all these tests are confirmatory of those given in connection with the special experiment outlined above. In testing the degree of immunity conferred by the different methods, one must use the same suspension of fresh rabic brain in all the different sets of immunized animals, including the control set. This is absolutely necessary, in order that all possible error may be eliminated. A series of such tests show the relative degree of protection only when the control sets of animals develop the disease according to expectations. The accompanying chart shows the relative degrees of immunity as here described.

The value of these animal experiments lies in developing an improved treatment for hydrophobia, and, in this connection, it may be stated that, in this institute and elsewhere in the United States, over 500 persons who were bitten by rabid animals have received this new method of treatment. It has been efficient in lacerating face bites. In no case treated by this method has hydrophobia developed, nor have there been any untoward symptoms.

Summary showing the relative degree of immunity obtained by the different methods of treatment.

Intracranial injection.	Pasteur method.	Högyes method.	New method.	Control animals.
Milligram.				
0.02[a]	Rabbit No. 1	Rabbit No. 1	Rabbit No. 1	Rabbit No. 1.[b]
0.023	Rabbit No. 2	Rabbit No. 2	Rabbit No. 2	Rabbit No. 2.[b]
0.027	Rabbit No. 3	Rabbit No. 3	Rabbit No. 3	Rabbit No. 3.[b]
0.033	Rabbit No. 4	Rabbit No. 4[b]	Rabbit No. 4	Rabbit No. 4.[b]
0.041	Rabbit No. 5[b]	Rabbit No. 5[b]	Rabbit No. 5	Rabbit No. 5.[b]
0.05	Rabbit No. 6[b]	Rabbit No. 6[b]	Rabbit No. 6	Rabbit No. 6.[b]
0.06	Rabbit No. 7[b]	Rabbit No. 7[b]	Rabbit No. 7	Rabbit No. 7.[b]

[a] 0.5 cubic centimeter of a 1: 25,000 suspension.

[b] Death from rabies.

HOW THE CAMPAIGN AGAINST YELLOW FEVER HAS BEEN CARRIED ON IN THE MEXICAN REPUBLIC.

Dr. Eduardo Licéaga, President of the Supreme Board of Health of Mexico and Representative of the Mexican Republic.

You will understand, gentlemen, that in dealing with this subject before such a distinguished assembly, in which I see representatives of all the nations that have carried on a struggle against this disease, and more especially of the American Government, who extinguished it in the island of Cuba and has brought about its complete disappearance in the Panama Canal Zone, I do not come with any idea of bringing any fresh information, but only to give a notice of the particular method we have employed in the struggle against the disease that during four centuries has prevailed on the Gulf littoral, that has made frequent incursion into the enormous length of the Pacific coast, and that would have rendered impossible the interoceanic traffic over the Isthmus of Tehuantepec.

The first condition to be complied with was that of giving unity and force to the struggle by placing it in the hands of the Federal Government. This was done when the States that covered part of the Gulf coast decided to abdicate their sovereign power in sanitary matters and place in the hands of the executive of the union the authority to direct the campaign.

It was then that the sanitary authorities of Mexico proposed a plan of campaign which, after being accepted by the Government, was put in practice in the following manner: Sanitary brigades were organized in each one of the secular focii of yellow fever, such as Vera Cruz, Merida, and Tampico; flying brigades were organized, with headquarters in Cordoba, for the entire State of Vera Cruz, in Coatzacoalcos, for the half of the isthmus, with jurisdiction up to Santa Lucrecia, the junction of the isthmus railroad with that coming from Cordoba; another flying brigade, with headquarters in the port of Salina Cruz, was charged with the care of the rest of the isthmus up to Santa Lucrecia.

As a matter of course, our first step was to send sanitary brigades to extinguish the epidemic that in an exceptional way had spread from Vera Cruz to Tampico; thence to Victoria, in the State of Tamaulipas, thence to Linares and Monterey in Nuevo Leon, to the northern cities in the State of San Luis Potosi, and through Tamaulipas to Laredo, Tex. This epidemic was extinguished in the space of three months, and after that, we had only to look to the suppression of the focii of endemia which remained along the littoral, and undertake a vigorous campaign on the legionary focii of endemia in Tampico, Vera Cruz, and Merida, as well as attend to the flying brigades I have above referred to, as well as to those places in which some outbreak of yellow fever might appear.

I again beg that this assembly will excuse my repeated mention of the fundamental data which science has furnished with respect to this struggle against yellow fever, even though these data are better known to you than to myself; but it is necessary for me to do so, because they have served as a basis for the plan of campaign that was developed, and they are the following:

It requires the concurrence of three factors to produce yellow fever, namely:

I. A person suffering from the disease.

II. A mosquito of the *Stegomya calopus* species, which, after taking infection from the patient, acquires the property of transmitting the same.

III. A nonimmune who, through the sting of such mosquito, contracts the disease.

If the concurrence of these three factors is indispensable for the propagation of yellow fever, their disassociation is the condition that will prevent that propagation.

Of these three factors, the first is the easiest to control by means of isolation, and in this case it is enough to place the patient or suspected person in a room whose windows and double doors have wire screens, previously driving out all the mosquitoes which might be found there by the well known means and preventing the entrance of others by the screens on the door and windows. Under these conditions the patient is kept strictly isolated; but in order to discover those who are sick it is necessary to search for them in their homes, and not wait for the declaration which it is the duty of the attending physician to give, as well as the father of the family, the director of the school, college, or workshop attended by the sick person, because the notice so given is slow in arriving and also because science, observation, and experiment have demonstrated that yellow fever passes the infection to the mosquito during the first three or four days of the disease. In order to carry out this plan we have provided for domiciliary visits; but, in order that these may be efficacious, it is also necessary to prepare a schedule of the nonimmunes living in each locality, according to the wards or districts, and these are placed under the charge of a physician with a sufficient number of sanitary agents who can visit those nonimmunes from day to day. Once the sick person is discovered he is isolated in the civil or military hospital, or even in a private hospital when he is a person of means and can pay for his treatment, in a wire-screened room such as that above referred to.

The second factor is the destruction of the mosquito. At present we are carrying out the destruction of the full-grown mosquitoes, because the principal struggle is limited to the destruction of their breeding places. As natural history has taught us how the females deposit their eggs, how these are transformed into larvæ, and afterwards into pupæ, how they are under the necessity of rising to the surface of the water in order to breathe the air, as well as other details regarding their ways of living in the interior of the houses, of the excursions they make outside and the distance they go, and how they take advantage even of the smallest pool of water to deposit their eggs, we have thus the necessary resources for their destruction. This is done by draining the pools or reservoirs of water that contain larvæ, by destroying them with the help of petroleum, by placing clean water in the cisterns and covering them with metallic cloth or an open cloth which will not allow the passage of mosquitoes, by covering the larger pools of water with petroleum, and by draining or canalizing those which are too large for this method. This is the system of procedure which we have followed for the last nine years in all places in which yellow fever formerly prevailed, and observation combined with experiment every day teaches us new details in the life of the mosquito which still more facilitate the struggle.

The third factor is the nonimmune person, and he is protected in his home by means of mosquito nets, but still more efficiently by covering the doors and windows with wire screens, as well as the outside verandas of the house in which he lives, thus permitting the free circulation of air in the interior of the dwellings, as required for purposes of respiration.

These are the resources which have served as a basis for the enactment of the rules to which towns must submit wherever yellow fever has prevailed in a endemic form.

As a part of the Gulf coast in which yellow fever has been endemic is crossed by railroads that facilitate communication, the sanitary authorities found themselves under the necessity of appointing sanitary agents to travel in each train, in order to take note of the travelers, the place from which they come, and their destination. If, on examining the passenger, the agent finds symptoms of fever, he at once applies the thermometer; and if the person is a nonimmune and can travel seated, he covers him with a hat that bears a large veil, covering the trunk of his body by means of small leaden weights that keep it close to the body and thus protects him against the stings of mosquitoes. If the fever obliges the person to lie down, he is covered with an ordinary mosquito net, and, in any case, he is conducted to the nearest sanitary station, where his isolation is continued until it is ascertained whether or not he suffers from yellow fever. In the latter case he is allowed to receive treatment wherever he desires, but if it is a case of yellow fever, he is kept isolated under the care of the sanitary authorities.

There is a detail about the disinfecting of dwellings which has been peculiar to us, and has been subsequently adopted in Cuba, and refers to the huts which are built with straw or palm roofs with walls of cane or badly jointed stone, and which can never be disinfected. As they are so numerous, it is impossible to destroy them by fire, because they amount to a large sum in the aggregate, and therefore our plan is to cover them with a kind of tarpaulin made of ordinary canvas, but sufficiently close to be proof against the escape of mosquitoes. Once the entire hut is covered with this tarpaulin, sulphur is burned in the interior, and, as the mosquitoes have no way of escape, they are necessarily suffocated.

Another small detail which it is well to know is that, in order to ascertain whether all the mosquitoes existing in a room have been destroyed by the fumigation, a test tube with live mosquitoes inside taken from the exterior and covered with a piece of muslin, is placed in every corner or point in which there is no circulation of air, and which is therefore unfavorable to the circulation of the sulphurous acid. If on completing the operation, the mosquitoes in the tube are found dead, there can be no question that the others, under more favorable conditions, have been reached by the fumes and are dead.

The result of this campaign has been as follows:

No serious epidemic has appeared since the year 1903 in any part of the national territory.

The endemia has been extinguished in Tampico since the 3d of November, 1903; in Salina Cruz since the 6th of November, 1904; in Coatzcoalcos since the 8th of September, 1905; in Vera Cruz since the 11th of February, 1909, and in Campeche the last case was observed on the 6th of November, 1910.

On the Pacific coast no case of autochthonic yellow fever has again appeared, and on the Isthmus of Tehuantepec none has been observed since the 21st of March, 1906, thus rendering it possible to carry on an interoceanic traffic over that Isthmus.

In Merida a few cases have been observed after the 1st of August, 1911, and, in fact, an epidemic was developed there that at first appeared to spread rapidly, but it was got under control by the measures adopted by the Federal Government under agreement with that of the State, so that the cases gradually diminished until the last one was registered on the 1st of May of the present year.

In San Juan Bautista, State of Tabasco, the first case was observed on the 4th of May last. This epidemic was not reported by the local sanitary authorities, and when it became known the Federal Government dispatched a brigade there, which has been operating from the 12th of August of this year. From the beginning of the epidemic 50 cases, with 22 deaths, have been reported.

The struggle against yellow fever has been continued without interruption during every season since the year 1903 up to the present date.

THE MUNICIPAL CLINIC OF SAN FRANCISCO.

Dr. Julius Rosenstirn, chief surgeon Mount Zion Hospital, chairman advisory commission, municipal clinic.

The detailed history of the struggle for the establishment of a sanitary regulation of the social evil is, more particularly, of local interest only. I shall not weary you with it. Let it suffice that, after nearly five years of unremitting work of the Civic League, an association of all the improvement societies of San Francisco, the Board of Health at last appointed a commission consisting now after various changes of two physicians, a lawyer, two business men, the superintendent of public schools, and a broad-minded clergyman, to establish a municipal clinic for the sanitary regulation of prostitution. The clinic was opened the 1st of March, 1911.

At the present time the municipal clinic is operated as follows:

Under orders issued by the police department all prostitutes are obliged to register at the municipal clinic and submit to a medical examination at stated intervals of five days.

Originally a segregated district was established, in which district, upon compliance with police regulations, houses of prostitution might be tolerated. This provision, however, is not strictly adhered to, the police commissioners allowing some houses outside the restricted district (strict segregation not having proved practicable, at least at present). The keepers of houses of prostitution are forbidden to harbor any inmate who does not possess a certificate from the municipal clinic showing that she had been found free from disease at her last examination. For the first offense of any infraction of this regulation the keeper of the house is called before the captain of the district and warned that a repetition will mean the closing of her house, a measure that has not proved necessary to date.

Two police officers, specially conversant with and fitted for this character of work, are permanently detailed to the clinic, and make daily visits to the various houses, checking up the inmates, and seeing that the regulations are complied with.

Clandestine prostitutes who are arrested and brought before the police courts are sent by the police judges to the municipal clinic for examination, pending the disposal of their cases, and, on condition of having their sentence suspended, are induced to present themselves for subsequent regular examinations.

Low dance halls and similar resorts with female attractions are regularly looked over now, and we expect within a short time to enroll the female contingent of these places on a special list of our clinic and oblige them to carry regular books.

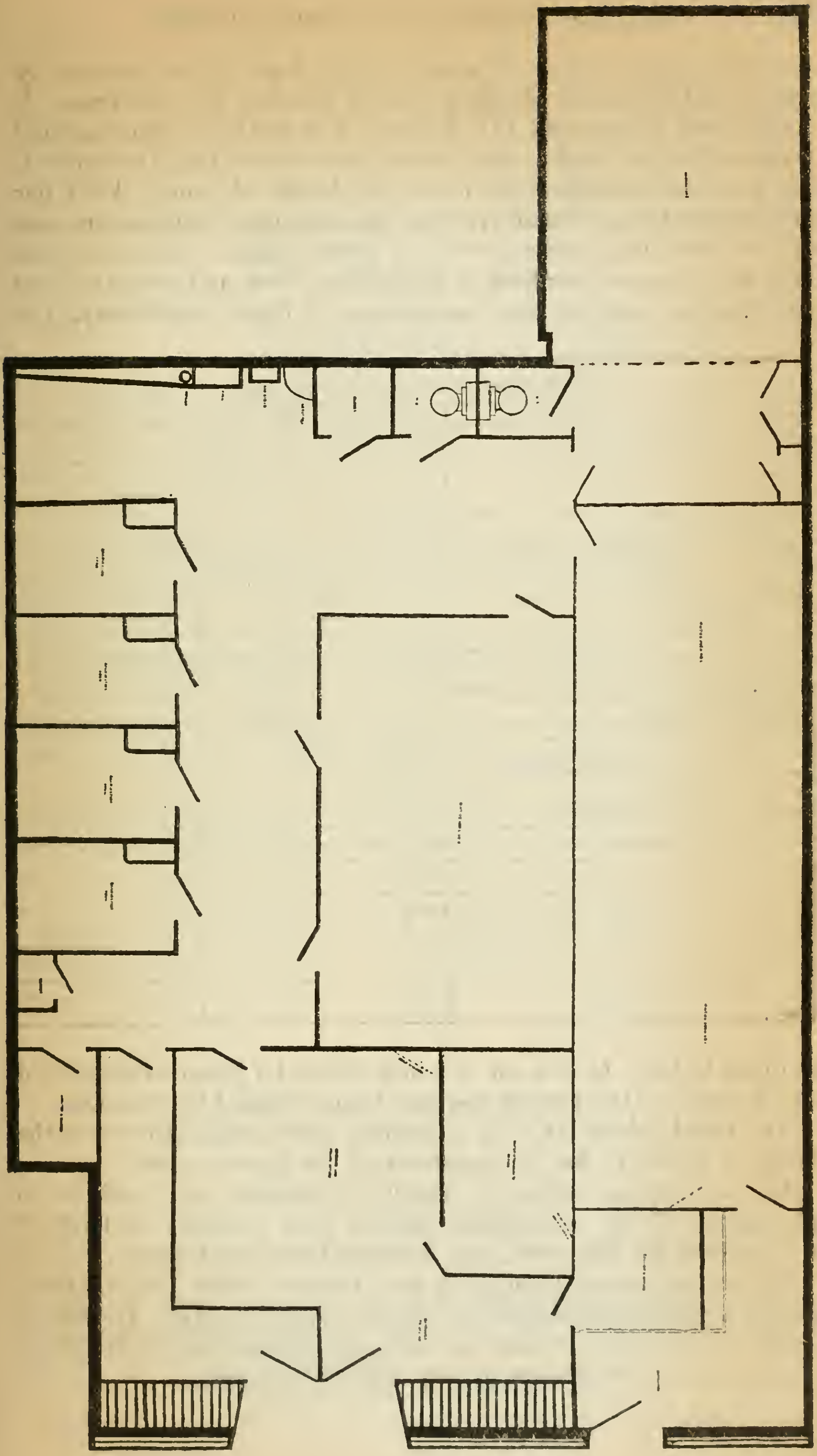
The clinic is operated by a citizens' committee, known as the advisory committee, consisting of Dr. Julius Rosenstirn, chairman; Dr. Martin Regensburger, president State board of health; Mr. Ford and Mr. Morrison, two business men; Mr. Roncovieri, superintendent of public schools, Father Wyman, a member of the Paulist Order, and Park Commissioner W. H. Metson, a prominent attorney.

The staff of the clinic consists of a superintendent and two female clerks, a chief clinician, an assistant clinician, a female physician for the morning-treatment hours, a bacteriologist (who is also a graduate physician), a trained nurse, a matron, and a janitor.

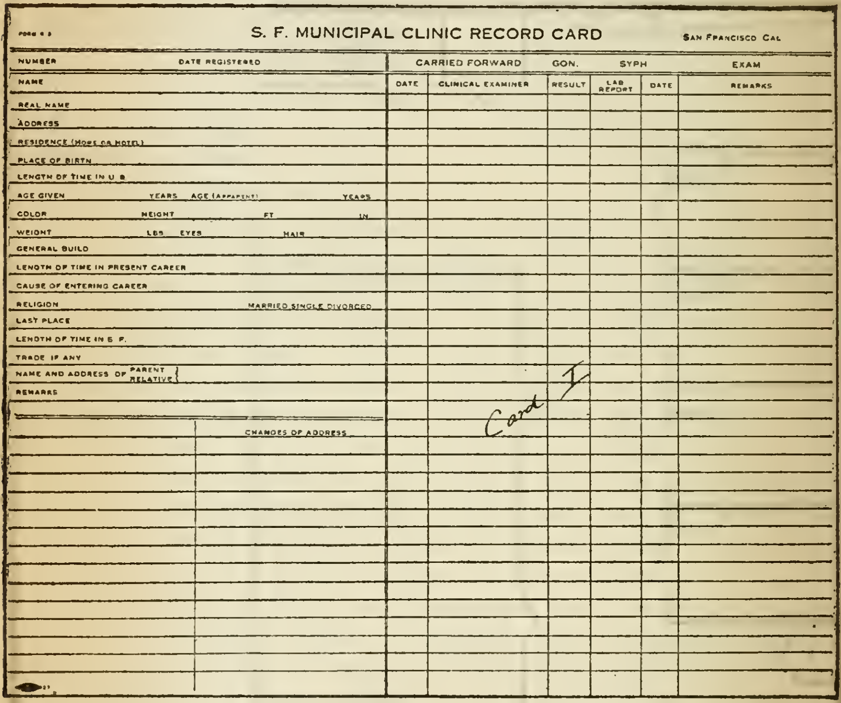
Every safeguard has been adopted against the possible practice of collusion in the examinations.

The attached sketch of the floor plan of the clinic will help explain the method used in examining patients. All women enter at door A, where they are registered on Form (1), and instructed to bring two photographs on their next visit. One of these photographs is then attached, as marked. The examination card (2) is given to her, bearing her number. The coupon attached is torn off and sent by carrying basket to the matron. The patient enters waiting room No. 1 and awaits her turn for examination. The matron calls the patients by their numbers; consequently the examining physician does not know the name of the patient nor the house she comes from—he knows her only by number. She is placed in one of the examining booths and the clinical examination made. If clinical symptoms of lues are found, a Wassermann is added to the examination. For gonorrhea smears are taken from any suspicious part, as urethra, Skeen's glands, vagina, Bartholinian, glands, and cervix, are deposited in the correspondingly marked divisions of the slide carrier, and sent to the laboratory for examination, while the patient goes into waiting room No. 2 to await her report. After the laboratory examination has been concluded the report is sent by carrier basket to the clerk in the record office, and, if satisfactory, the patient is furnished with a small pocket case which contains a duplicate of her record and a card showing the date of her examination and that the same was satisfactory. This card is signed by the clerk, whose signature is the one recognized by the police. The record is firmly fixed in the book by means of an eyelet, and can not be removed without destroying the case. The patient then leaves by the exit door (door B).

In the office the master card (1), with one photo attached, is filed numerically, controlled by index cards, white for whites and blue



for other races. There is also a record kept of the inmates by houses, and the names are filed both by the first and surnames. A control card is made out (3), which is filed under the four cardinal points of height, weight, color of eyes, and color of hair, thus providing a further identification in case of change of name. After her first registration a woman receives, on subsequent examinations, one of the cards (2), marked when to report again. Upon her next visit she surrenders her book at the cashier's desk, and after the same procedure as upon her first examination, if found satisfactory, it is returned to her. In case she is found diseased a blue-treatment card (4) is issued to the patient, the stub being retained by the nurse.



S. F. MUNICIPAL CLINIC RECORD CARD

SAN FRANCISCO CAL

NUMBER DATE REGISTERED

NAME

REAL NAME

ADDRESS

RESIDENCE (HOME OR HOTEL)

PLACE OF BIRTH

LENGTH OF TIME IN U S

AGE GIVEN YEARS AGE (APPARENT) YEARS

COLOR HEIGHT FT IN

WEIGHT LBS EYES HAIR

GENERAL BUILD

LENGTH OF TIME IN PRESENT CAREER

CAUSE OF ENTERING CAREER

RELIGION MARRIED SINGLE DIVORCED

LAST PLACE

LENGTH OF TIME IN S. F.

TRADE IF ANY

NAME AND ADDRESS OF PARENT / RELATIVE

REMARKS

CHANGES OF ADDRESS

CARRIED FORWARD		GON.	SYPH		EXAM
DATE	CLINICAL EXAMINER	RESULT	LAB REPORT	DATE	REMARKS

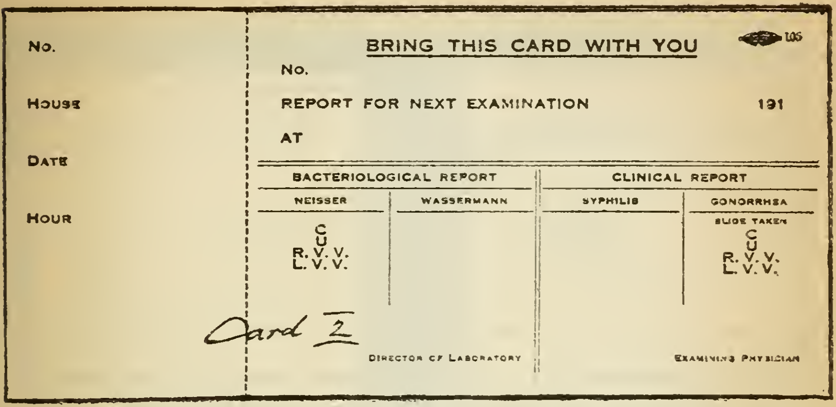
Card I

The female physician is in attendance every morning between the hours of 9 and 11 for the treatment of the regular cases.

In case a woman refuses to submit to treatment, and continues to ply her trade, she is arrested, charged with vagrancy, ordered to the hospital for treatment, and detained there until cured.

The examinations are made in the afternoon, from 1 to 5. Each person registered is supposed to report every five days. In case of illness or menstrual trouble she must notify the clinic by telephone of the cause of her failure to keep her appointment.

A fee of 50 cents is charged for each examination. No other charge is made, and no gratuity of any kind can be accepted by any attaché of the clinic. (Large notice cards notifying the women of this rule are posted throughout the clinic and on the door of each booth.)



No.

House

Date

Hour

BRING THIS CARD WITH YOU

No.

REPORT FOR NEXT EXAMINATION 191

AT

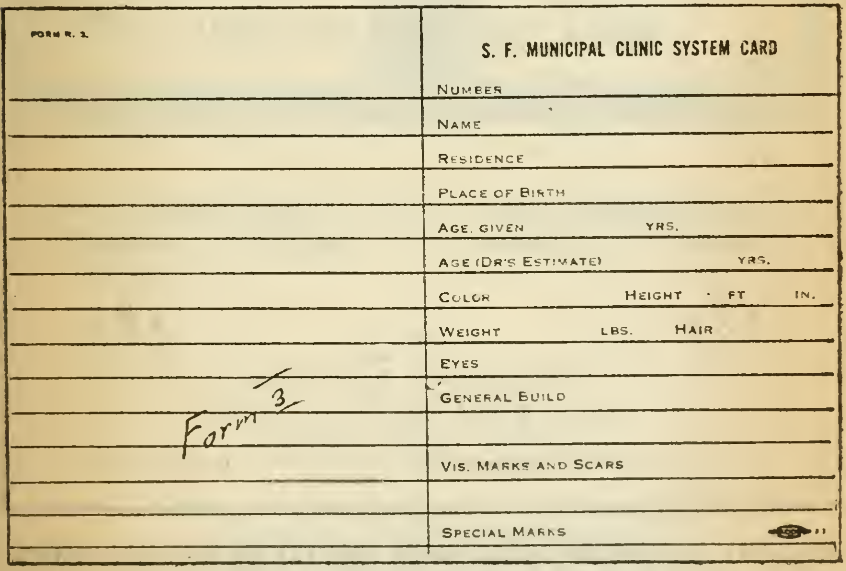
BACTERIOLOGICAL REPORT		CLINICAL REPORT	
NEISSER	WASSERMANN	SYPHILIS	GONORRHEA SLIDE TAKEN
C U R. V. V. L. V. V.			C U R. V. V. L. V. V.

Card 2

DIRECTOR OF LABORATORY

EXAMINING PHYSICIAN

All treatments furnished by the clinic are free to the patient. In cases that require hospital care, or where financial difficulties or self-support make it desirable, or in obstreperous cases, hospital attention is provided and paid for by the clinic. A patient is charged only for her regular examination.



FORM R. 1.

S. F. MUNICIPAL CLINIC SYSTEM CARD

Number

Name

Residence

Place of Birth

Age, given yrs.

Age (Dr's Estimate) yrs.

Color Height ft in.

Weight lbs. Hair

Eyes

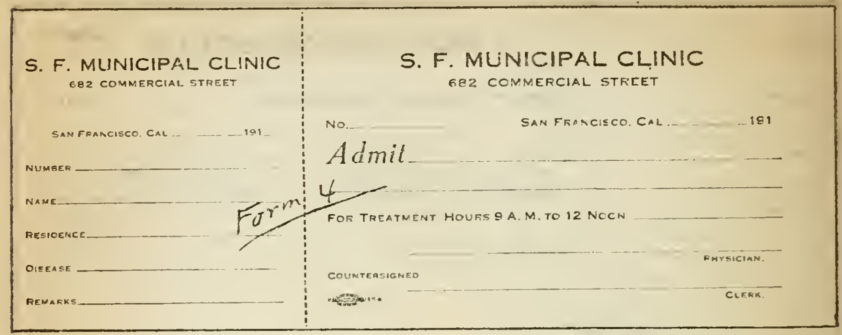
General Build

Vis. Marks and Scars

Special Marks

Form 3

The clinic is supported entirely by means of this fee. The funds are under the control of the advisory committee, and are audited every month by a regular public accountant. A surplus fund is accumulating, and is being saved with a view of establishing later an interim home for rescued girls of this class.



S. F. MUNICIPAL CLINIC
682 COMMERCIAL STREET

SAN FRANCISCO, CAL. ________ 191__

NUMBER ____________

NAME ____________

RESIDENCE ____________

DISEASE ____________

REMARKS ____________

S. F. MUNICIPAL CLINIC
682 COMMERCIAL STREET

NO. ________ SAN FRANCISCO, CAL. ________ 191__

Admit ____________

____

FOR TREATMENT HOURS 9 A. M. TO 12 NOON ____________

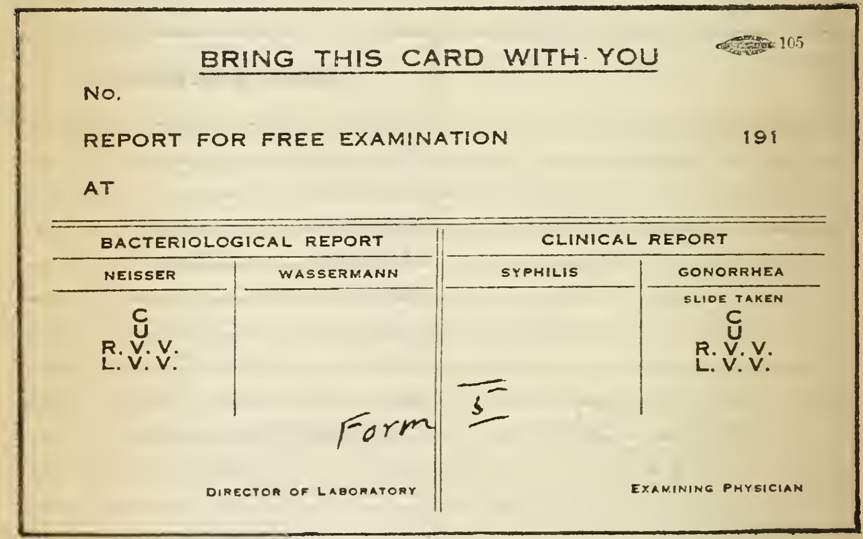
____________ PHYSICIAN.

COUNTERSIGNED

____________ CLERK.

Form 4

After the infected girl has been declared cured by her physician she must report to the clinic on three successive days, when a smear is taken each time, and, if advisable, a tentative nitrate of silver injection is added, and examined. For syphilis a Wassermann is made, together with a thorough examination. Should the examination prove negative she is furnished a card (5) for free examination, which must be made by the chief clinician, and, if everything is all right, her book is returned to her.



105

BRING THIS CARD WITH YOU

NO.

REPORT FOR FREE EXAMINATION 191

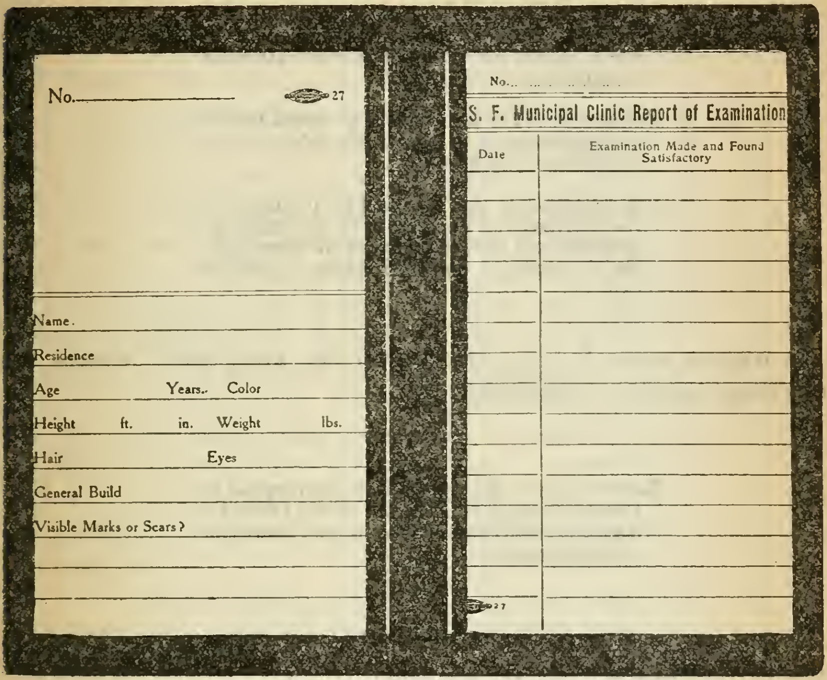
AT

BACTERIOLOGICAL REPORT		CLINICAL REPORT	
NEISSER	WASSERMANN	SYPHILIS	GONORRHEA
C U R. V. V. L. V. V.			SLIDE TAKEN C U R. V. V. L. V. V.
DIRECTOR OF LABORATORY		EXAMINING PHYSICIAN	

Form 5

The laboratory of this institution is fully equipped, and Wassermann tests are made in all suspicious cases and in every new registration.

This card (4), a sample of which is here reproduced, is inclosed in every book, and particular care is taken to help the women understand it.



No.

Name.

Residence

Age Years. Color

Height ft. in. Weight lbs.

Hair Eyes

General Build

Visible Marks or Scars?

No.

S. F. Municipal Clinic Report of Examination

Date	Examination Made and Found Satisfactory

Book for portrait, description, and records.

Inside the door of every private room of the houses of prostitution this card is posted:

ASK FOR THE

MUNICIPAL CLINIC BOOKS

AND SEE THAT THE LAST EXAMINATION HAS TAKEN PLACE WITHIN FIVE DAYS, PRECEDING TO-DAY.

The public should realize, however, that notwithstanding the great improvement of conditions through these regular examinations, no guarantee of absolute safety can be assured.

Municipal Clinic,
682 Commercial Street.

In every booth and in all waiting rooms, cards reading as follows are shown:

> The fee paid for examination is the only fee that will be accepted by this institution. Any cases coming for treatment receive attention absolutely free of charge.
>
> No gratuity of any kind can be accepted by any nurse, physician, or attendant under any circumstances whatsoever.
>
> Any violation of this rule will be punished by the discharge of the employee accepting the gratuity, and the penalizing of the person giving the gratuity by withholding the certificate.

In waiting room No. 2, where the women await their reports, the following notices are displayed:

> Patients sent to the city and county hospital for treatment are paid for by the clinic, treated in a special ward, and are not subject to student experimentation.

and above a properly locked box, of which the chairman of the advisory committee only has the key:

> Deposit complaints here. This box will be opened by the advisory committee only. Any complaints attended to promptly.

This now is in brief outline a sketch of the history and method of our 18 months' old work of a sane and humane sanitary reglementation. What is the attitude toward it of our people, laity and professional, and what are the arguments brought forward against regulation?

Talcot Williams declared, "The laity of America would never either register prostitution or insist on compulsory examination, neither would it segregate the prostitutes."

Is it really the American laity who opposes so strenuously, so unalterably, a sanitary protective measure? The laity who, upon the dangers of contagious diseases made known by the medical profession in cases of measles, scarlet fever, diphtheria, smallpox, and so on, willingly submit to quarantine isolation, or forcible removal to a contagious-disease hospital? The people approve even a life-long isolation or incarceration for leprosy, a disease known to be so very difficult to transmit by contagion that this fact, now established through some isolated cases, has long been doubted.

Would they object so strenuously, if they knew the dangers, the terrible ravages, due to venereal diseases; the fact that 80 per cent of deaths from inflammatory diseases peculiar to women, 75 per cent of all gynecological operations, and more than 60 per cent of all gynecological work is due to infection? That up to a few years ago, before the Credé prophylactic eye treatment was generalized in Germany, and up to now, where it has not been adopted, 80 per cent of disastrous inflammation of the eyes (ophthalmia), and 20 to 25 per cent of all blindness has been caused by gonorrheal infection, chiefly due to the passing of the newborn babe through the diseased maternal genitals. Is it not enough that about 80 per cent of syphilis-infected children die in their mothers' womb, and that the 20 per cent living carry with them the life-long marks and defects of mind and body as their heirloom, transmissible again to their offspring? Or would they also consider, as a negligible quantity, the effect of acquired syphilis, its destructive work on the vital organs, its causation of paralysis, locomotor ataxia, insanity, with the unceasing suspense of the Damocles' sword during the victim's lifetime? Perhaps the American laity might also regard the enormously great annual number of victims to infection with venereal diseases as but a trifling matter.

The Prussian Government, in the year 1910, felt curious enough to send inquiry sheets regarding the number of such cases treated during the preceding year to each and every physician within its dominion. A conservative estimate, based on the answers received, gave the astounding result of 500,000 cases for the Kingdom in a year. Even if we allow for our country conditions ever so favorable as compared with Prussia in this particular respect, and simply grant for America's unhampered dissemination of venereal diseases no greater numerical infection than Prussia shows with its strict regulation, we would have in our own country the amazing sum of 1,500,000 venereally infected cases annually. Do you believe that if this were generally known the public at large would not eagerly adopt any and all means that promise even a slight degree of betterment?

But instead of publishing these appalling facts broadcast, the public press and periodicals shun the merest mention, and, still more, the discussion, of the sex problem and its dangers, the greatest perhaps, at the present time, which threaten the health and strength of our Nation. In place of such shocking reading matter, many of their columns reek with the chaste advertisements of thinly veiled solicitations of prostitution from so-called masseuses, and the freely offered help of abortionists to hasten retarded or irregular menstruation.

This prudery of the press, stimulated through the fear of excommunication by the purists, the moralists, and the Pharisees, extends even to scientific publications. In a recently published work of 16 enormous volumes (the Americana), an American encyclopedia in the style of the Encyclopedia Britannica, one looks in vain for such words as "prostitution," "prostitute," "nymphomania," etc. Even the word "sex" has been carefully omitted.

Private endeavor has come to the rescue, however, and all honor is due to the courageous men who first founded the American Society of Social and Moral Prophylaxis of New York, the society which took the initiative in popularizing the knowledge of normal and pathological conditions arising from sexual intercourse. Similar associations were formed in other cities, and finally a national association, the American Federation for Sex Hygiene, was formed for the education of the public in the physiology and hygiene of sex.

In falling heir to this task, the federation did not limit its work to the spreading of the new gospel of sex hygiene, but passed resolutions which, by virtue of the society's adoption, were raised to and heralded as dogmas and held unassailable.

Following the examples of the International Congress of Brussels and the German one for the Prevention of Venereal Diseases, the Federation for Sex Hygiene pronounced, as the first dogma, that sexual intercourse is unnecessary to health; or, in other words, that absolute sexual continence is not injurious. It is unnecessary to call your attention to the fact that the foremost neurologists to-day contest the truth of this pronunciamento very sharply, so that this infallible dogma, like its relatives of the ecclesiastical councils, is subject to correction.

Another dogma, pronounced later but with equal assurance, is that all attempts at reglementation must be abandoned; they are useless, nay, even injurious, to any endeavor to prevent the spread of vereneal diseases.

Its full and permanent adoption throughout would abolish a sanitary regulation of prostitution, this main source of infection of venereal diseases. Even if such a high-minded association declares itself for a dogma of that sort, should that throttle alike regulatory progress and prevent the discussion of this momentous question forever? I do not think so, and will try to review briefly the points of opposition to reglementation.

It is asserted that hitherto inspection has been imperfect in the registered houses of prostitution and that it does not reach secret prostitution at all. Let us grant that for argument's sake. But see what this imperfect inspection accomplishes:

I show you here a tabulated report of our activity during the 18 months of our clinic's existence. You see the reduction of morbidity from 146.8 per 1,000 to a fairly steady rate of about 50 per 1,000. The one month of May requires an explanation. During the month of June the American Medical Association convened in Los Angeles and the president of our last board of health read a paper there before that association treating of the work of the then 3-months-old clinic, for which the figures of these first three months were used. In his endeavor to present a most favorable impression his influence as president of the board of health and the then managing spirit of the clinic was perhaps unconsciously exercised to keep the percentage of diseased cases as low as—well, as you see it here—while, when normal conditions were reestablished, the percentage reassumed its normal proportions:

Morbidity report.

	Individuals examined.	Examinations.	Total diseased.	New registration.	Percentage of diseased cases on new registration.	Diseased cases found on first examination of newly registered.	Diseased cases per 1,000.
1911.							
March	647	1,487	95	647	8	53	146.8
April	905	1,929	76	369	6	22	83.9
May	819	3,452	14	105	3	4	17
June	747	2,397	42	77	5	4	56
July	740	2,525	76	84	7	6	102.7
August	744	3,084	38	91	7	7	51
September	776	2,564	39	89	2	2	50
October	724	2,963	42	104	5	6	58
November	693	3,231	42	93	10	10	60.6
December	831	3,353	37	109	9	10	44.5
1912.							
January	924	3,242	43	110	5	6	46.5
February	780	2,885	23	77	6	5	29.5
March	789	2,962	38	62	11	8	48
April	866	3,437	48	68	20	19	55.4
May	790	3,214	44	80	10	9	68.3
June	650	2,786	29	49	10	5	44.6
July	740	2,925	40	49	20	10	54
August	650	2,730	37	40	20	8	56.9
September	710	2,697	13	50	22	11	18.3
October	710	3,149	37	84	23.8	20	52.1
November	831	3,349	23	42	23.8	10	27.6
December	735	3,105	39	66	51.5	34	53

The houses containing by far the largest contingent of prostitutes everywhere are the cheap houses—with us the "one-dollar" houses. The daily expenses of an inmate of such a house are at least $10 per day—$3.50 to the keeper of the house, $2.50 for food, rent for her private sleeping place from $1.50 up; the rest for the clothes, washing, and incidentals, not counting the contribution for the protection, and to the support of the cadet. In order to keep even she has to accommodate 12 to 15 visitors a day, a number ordinarily considerably exceeded. Let us say that only 50 per cent of about 1,000 active registered prostitutes occupy these cheap houses. Our figures show a reduction to nearly one-third of the original morbidity during the short period of our existence. Deduct from that a sufficient allowance for possible sources of error, we still have 50 per cent and to spare. Among those 500, 75 diseased women would have been plying this trade except for the action of our clinic. Regulation eliminated at least 37; 37 times 10 makes 370 men a day, or 135,050 men a year, who escape the risk of infection, not including all those who were equally fortunate in the high-priced houses by reason of the control we exercise.

Is that not a number large enough to stimulate our efforts to overcome any obstacle and all prejudices in order to help the parties concerned? As to secret prostitution, I have outlined to you what we are doing to have that element submit to regular examinations, and we feel certain of getting, in time, a very large proportion. If they once realize, as we have demonstrated to the satisfaction of their registered companions in misery, that no graft is practiced or permitted, and that this institution, by its regular sanitary inspection, acts in a friendly sense and manner for their benefit, that contingent will voluntarily flock to the clinic. Their confidence has to be gained by gradual and difficult education, and no unwarranted harassment practiced or permitted.

"Oh!" cry out the abolitionists, purists, and moralists, "you are condoning a crime!" Are we, really? Have the views upon sexual relations not undergone any change from the medieval ecclesiastical condemnation of many centuries ago?

While, from an ethical standpoint, prostitution constitutes one of the most revolting degradations of the human frame and mind, the passing of money in an otherwise inoffensive action should not stamp it legally as a crime. Who knows better than you, my dear co-workers, that the grinding machinery of our social structure is responsible for the continuous supply in this nefarious trade? A lenient protective treatment of those unfortunates, who are compelled, or think they are compelled, to sell their bodies, corresponds to the charitably understanding spirit of our scientific age, in contrast with the harshly unbending one of fanatic orthodoxy.

The regulation we aim at gives also a protection against extortion. An obedience to the sanitary measures and to the laws of ordinary circumspection gives freedom from authoritative harassment. As protection against this nightmare of their existence is no longer essential, the cadet loses a large share of his importance and influence, and a less odious relation between the prostitute and her friend may be hoped for.

It has been argued that sufficiently frequent examinations of prostitutes charge the community enforcing them with an exceedingly heavy expense, inordinately so, relative to the good it accomplishes. Whilst we do not recognize that any reasonable amount of money spent for improving the health of a community is wasted, we have demonstrated beyond a reasonable doubt that this work can be done effectively for a comparatively small amount, and, further, that the total expense can and should be borne by the main beneficiaries, who pay it willingly for control against infection, and insurance of a paid-for right to absolutely free private medical treatment.

Our success with the treatment of gonorrhea has been very gratifying. Before January, 1912, financial difficulties made it necessary to entrust our graduate nurse with carrying out the ambulatory treatment of the infected patients of the clinic under the supervision of the head clinician. Since the first of the year we have employed an excellently fitted female physician for this department of our work, and the percentage of the total number of detained infected cases applying for treatment by the clinic has gratifyingly increased.

Month.	Number of diseased cases.	Treated in clinic.	
		Number.	Per cent.
1912.			
January	43	25	58.1
February	23	13	56.5
March	38	26	68.4
April	48	30	62.5
May	54	29	53.7
June	29	25	86.2
July	40	33	82.5

Of these 181 cases treated by Dr. Campbell at the clinic, 129 have been discharged and cured; 42 cases left without completing their course of treatment and disappeared. Of the 129 cases mentioned above, dismissed as cured, only 6 have had recurrences, 3 of whom had refused to have the Bartholinian glands slit open for treatment.

In addition to the above cases, 6 cases of syphilis were treated under our auspices at the hospital, and, after injections of salvarsan and the disappearances of clinical evidences of disease under this and subsequent treatment, had their books returned to them subject to observation and control.

The gonorrhea cases have to undergo three successive examinations, followed, where advisable, by a tentative nitrate of silver injection. After three examinations and the nitrate of silver injection show the absence of acute or chronic inflammatory clinical symptoms and of the Neisser's organisms, the patient has her book returned to her, and is thereby entitled to take up her trade again.

We therefore can not agree with those who claim gonorrhea incurable, and give this reason for an alleged inefficiency of sanitary regulation. Our results have proved the fallacy of this. A cure of syphilis can never be absolutely claimed, but in practically all cases a rational treatment insures at least a temporary innocuousness to others, which should be controlled by regular examinations.

Let us look over the statistics made by honest, painstaking, and impartial investigators regarding the effect of regulation upon public health. Statistics of such a nature, to be of any value, must fulfill peculiar conditions. During the term of observation the material must be practically unvarying as to age, physical strength, and conditions of life and living. The medical control must be constant and accurate, and, where comparisons shall be deemed valid, similar standards must prevail. The armies of the various nations are the only large bodies of men that fulfill, to a nearly ideal degree, all these claims, and we shall occupy ourselves chiefly with army reports.

In 1871 the British Royal Commission and, in 1879, a select committee were appointed to investigate the effect of the contagious-diseases prevention act. This was, as you all know, an act providing for the compulsory medical examination of prostitutes and by detention in the hospital of those found diseased in garrison towns. The direct evidence collected by these two official bodies was strongly in its favor, alike with the diminution of disease among the troops in the protected towns, the absence of complaints, and the good effects on public order, to which clergymen and other residents testified. The majority of the committee reported accordingly after a three years' inquiry. Agitation against the act by purists and moralists became very violent, however, and in 1883 the House of Commons, with the usual understanding of legislative bodies for medical affairs, passed resolutions condemning compulsory examination by a vote of 182 to 110.

In order to let you see the character of some of the evidence gathered by these committees of skilled observers, I will show you their comparative table demonstrating the decline in cases of venereal diseases in towns protected by the contagious-diseases prevention act and in unprotected towns. Primary sores, secondary syphilis, and gonorrhea are considered separately.

Influence of British contagious diseases prevention act on army health.

Period.	Decline for—					
	Primary sores.		Secondary syphilis.		Gonorrhea.	
	Not subject.	Subject.	Not subject.	Subject.	Not subject.	Subject.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1861–1872	9	40	5	34	3	8
1860–1873	26	60	10	49	18	24

That even a not very humanely conducted control by police administration is effective, in spite of the often-expressed doubts, is shown by the gradually lessening number of attempted escapes from control, and the number recovered by the police, in Paris, as reported before the Brussels congress.

Only the first and last years are given here:

Report of the Conférence Internationale pour la Prophylaxie de la Syphilis et des Maladies Vénériennes, Bruxelles, 1909.

Year.	Registered.	Disappeared.	Restored to control.
1888	4,591	1,779	1,491
1889	4,591	2,125	1,309
1896	5,900	1,190	615
1898	6,018	344	498

Parent-Duchâtelet, Behrend, Hügel, and many other American and European authors, and nearly all other writers prior to 1850, never doubted that the immense sanitary advantages from that kind of regulation were easily demonstrable.

The eminent Russian physician, Stürmer, is authority for the statement that, in Russian cities, when control is released, venereal diseases increase, and that the reverse happens when control is taken up again. In the city of Dorpat, well known on account of the severe character of its local venereal diseases, the commander of the garrison reported, in 1898, that, after three years of effective regulation, not 1 out of 1,000 men stationed there had contracted syphilis during the year.

Statistics from Norway, especially from Christiania, indicate the same relations between control and prevention of diseases. The Italian army statistics show an undoubted increase of the spread of venereal infections after the abolition of regulation. You may judge for yourselves from a comparative statistical table of the morbidity from venereal diseases in some of the various European armies during the 20 years from 1876 to 1895, inclusive. The arrangement of the countries begins with the one where regulation is strictest, and passes gradually to the one where it has been abolished.

Admission to hospital for venereal diseases per 1,000 in European armies.

Year.	German.	French.	Austrian.	British (home).	British (India).
1876	28.8	57.0	65.8	146.5	203.5
1877	30.0	57.8	66.9	153.2	224.4
1878	36.0	59.7	75.4	175.5	291.6
1879	38.5	63.7	81.4	179.5	253.3
1880	34.9	65.8	75.7	245.9	249.0
1881	39.2	60.6	79.0	245.5	259.6
1882	41.0	62.0	73.7	246.0	265.5
1883	38.2	58.9	73.3	260.0	271.3
1884	34.5	52.1	73.5	270.7	293.5
1885	32.6	50.7	69.0	275.4	342.6
1886	29.7	49.6	65.8	267.1	385.8
1887	28.6	51.6	64.4	252.9	361.4
1888	26.3	46.7	65.4	224.5	372.2
1889	26.7	45.8	65.3	212.1	481.5
1890	26.7	43.8	65.4	212.4	503.6
1891	27.2	43.7	63.7	197.4	400.7
1892	27.9	44.0	61.6	201.2	409.9
1893	....	42.8	64.5	194.6	406.0
1894	....	40.8	64.8	182.4	511.4
1895	....	....	....	173.8	522.3

I have been informed that until lately our own Army and Navy showed the same conditions as the English.

In the light of these investigations into the usefulness of sanitary control, we feel that, regardless of the outcries of so-called purists and moralists, further efforts with regulation are certainly justified.

The attitude of the American public is not as forbidding as these people would make us believe. Cities like Chicago, Cincinnati, and Sacramento, whose representatives have inspected our work, have made requests for samples of our forms and for information regarding our methods, with a view to introducing both.

We wrote to every city of over 25,000 inhabitants in the United States, asking for and receiving from 83 information as to the presence or absence of regulation in their municipalities, their means for the prevention of the spread of venereal diseases, and the effect of either.

Thirty of these cities tolerate prostitution under all degrees of regulation, from the merest apology to well-organized systems, and claim generally satisfactory results. Fifty-three cities claim to prohibit prostitution absolutely; 26 of them, mostly New England towns, like Fall River, Worcester, Lowell, and New Bedford, claim satisfactory results and total absence of prostitutes. All Massachusetts cities of this category assert with strange unanimity that their young men, if sexually inclined, go to Boston to gratify their desires, whilst Boston, in the report sent us, states its absolute prohibition of prostitution. Nothing more convincing of the necessity of sanitary regulation could be given than the answers to these questions offer in their totality, and I sincerely regret that the lack of time does not allow me to read you this interesting documentary evidence.

The voices of those who come into close contact with these elements of our society, who see their daily life and know intimately their associates, their practices, and their various ramifications extending into all parts of our social structure, speak loudly enough for the benefits, for the desirability, of regulation, but they are timid as yet, and are drowned by the vociferous outbursts of the purists.

Even such a highly intelligent and conscientious official as Police Commissioner O'Meara, of Boston, writes in his most interesting Record of the Enforcement of the Law against Sexual Immorality (since Dec. 1, 1909, to 1911):

> If a future police commissioner were intending to pursue the same course with respect to the business of vice that has been followed for four years, I should advise him that he might expect loyal support from the police, when once he had convinced them that he was in earnest, little encouragement from courts, bitter hostility from persons whose profits were curtailed, indifference from the public, and from a few enthusiasts in the name of social purity, whose admirable purposes are not sustained by straight and intelligent thinking, he would be sure to receive some measure of abusive criticism.

A certain sort of sanitary regulation we must have. We need it for the protection of the coming generation, for the protection of our youth, of our Nation's manhood and womanhood, and especially for the protection of the unfortunate women, the victims of social imperfections and cruel misfits, to correct which it may take centuries to come and we can not, dare not wait.

But just as much as we advocate regulation, we want it a different kind from what it has been in the past—a new regulation unadulterated with persecution. No regulation, we believe, will ever gain the sanction of right-minded people or gain its end unless it is first and principally based upon an absolutely helpful and fair dealing with the prostitutes themselves.

The second Brussels conference passed, as resolution No. 2, "That prostitutes suffering from venereal maladies ought to be considered, not as criminals, but as patients." We go further than that. We consider all the city's prostitutes as patients of our clinic, to whom we extend the helping hand of the medical friend and adviser, and last, but not least, of the educator. We educate them to the knowledge of the perils of their trade, and of the benefits to be derived from a controlling institution like the municipal clinic.

We gain their confidence by absolutely fair and dignified treatment, coupled with the convincing assurance that no graft of any kind is sheltered or condoned.

We raise their self-esteem by making them feel that the trifling examination fee charged (or remitted, if financially distressed) for a temporary clean bill of health in a perilous trade gives them a rightful claim to free medical treatment, should the misfortune of infection befall them. This free treatment entitles them to paid-for hospital care, if desirable or necessary, and exempts them from an objectionable and sometimes humiliating demonstration before student classes. And let me add right here, although we enforce no lock-hospital methods, but have our patients distributed in regular order of admissions throughout the wards, we register only one escape among all the hospital-confined cases.

We educate these women by impressing upon their generally dull and undeveloped minds the ever-present danger of infection, with its disastrous consequences, and, through the oral instruction of our medical staff, teach them as well as possible to examine their visitors and recognize the symptoms of venereal disease, if present.

I have exhibited the cards we place on the inside of each and all inmates' doors to their private rooms for the information and benefit of the patrons of these resorts. They call upon the visitor to inspect the girl's book and to convince himself of an official examination having been made within the preceding five days. These cards help us toward the regularity of our control, but, at the same time, avoid the raising of a feeling of false security in the public mind by announcing that in spite of all these precautionary measures no guaranty of safety can be assured.

The large and growing percentage of infected women that apply for treatment in our clinic relieves us from the reproach that our system of regulation drives these unfortunates into other parts of the State or country, where, unhindered by regulation, they might continue their trade.

We are free from all kinds of political influence. We were severed accidentally from the McCarthy board of health, which created our advisory committee. A judicial decision unseated several of the board's members, among them its president, an ex officio member of our committee, who lost his membership through this decision. When our committee, in March, 1912, approached Mayor Rolph's newly appointed board of health with the request to take over the municipal clinic, with its fully-paid-for equipment and its cash surplus in the bank, in order to relieve the committee from its labors, we were refused. Not being willing to abandon a task which the men who were in it had recognized as most important and beneficial to the community at large, the committee continued its work alone, independently of the board of health, but with the gratifying protection and active support of the police authorities, executive, and judicial. They have, after faithfully watching our endeavors, learned to trust us, and I may say, simply stating a fact, that we enjoy at the present time the confidence alike of the legal authorities and the poor unfortunates whom we consider our wards.

The greater part of this encouraging result could only be gained by the tactful and efficient services of our entire staff, their assisting nurses, the police officers, the office force, and by the enthusiastic devotion of the clinic's superintendent.

This spirit made possible the fact that, although rescue work is not included in our program and no missionary work attempted, still, in the short time of our existence, 121 women were led into the decent paths of society and cared for during the intermediate period, until appropriate work could be provided for them. Forty of them have returned to their former life; the others have, to the best of our knowledge, not relapsed up to date.

In addition, six neophytes were saved from entering a life of shame, and five girls under the age of consent (18 years) were turned over to the care of the juvenile court.

Through the activity of our institution our officers arrested 12 white slavers, who were prosecuted, some in the Federal and some in the State courts, with the result that, in these most difficult cases, 8 were convicted, only 2 acquitted, and 2 are still awaiting trial.

Appreciating the opportunities that our institution furnishes for the discovery of this class of criminal cases, the municipal, and especially the Federal, authorities continually ask our help and assist us in our efforts.

You will easily see that our work does not oppose or hamper rescue work or educational efforts of the society for sex hygiene type. On the contrary it materially helps every kind of work for the betterment or, if you will, the abolition of these sad conditions, and we are most willing and glad to assist in every possible way.

Fortunately for the work our independence from politics permits us to fill positions on the basis of merit only, and it is perhaps this favorable administrative condition that caused the incumbent president of the board of health, a lawyer of high standing and reputation, to express to the author of this paper his opinion "that the present independent state of the municipal clinic should be preserved, so that persistent and sometimes irresistible political demands for appointments might be ignored."

If I may formulate certain requirements for the success of modern institutes for the sanitary regulation of prostitution, the following would be fundamental:

(1) Prostitution, if regularly and officially supervised, although morally and socially abhorred, should not be punishable criminally; its regulation should be left to municipalities or counties.

(2) The display of a spirit of helpful, dignified sympathy by the institutional officers and employees for the unfortunates who come under their administration.

(3) A persistent effort to educate the clients of the institution to the perils of their trade, to the methods of their avoidance, and to an appreciation of the institute's beneficial services for their protection.

(4) The inculcation of self-dependence by charging a small examination fee, sufficient to maintain the expenses of the institution, and thereby insuring free and private medical, ambulatory, and (unlock) hospital treatment. This could be so arranged as to have the landladies assume part or all of the charges.

(5) A police detail attached to the institution for surveillance and rounding-up of delinquents by specially fitted officers.

(6) Control of examination, to be helped by cards similar to ours affixed in the private rooms of houses of prostitution, calling for inspection of certificates of examination by the visitors, but disabusing their minds as to a possible feeling of absolute safety.

I firmly believe that if institutions for the sanitary regulation of prostitution were established and carried on along these lines throughout our country the number of infections with venereal diseases would be very materially lessened, the injuries as well as the opprobrium resulting from the existence of prostitution greatly diminished, and a class of human beings benefited for whose debasement and degradation our vaunted civilization must be proclaimed chiefly responsible.

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THE ERADICATION OF THE SOCIAL DISEASES IN LARGE CITIES.

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I am here to-day to discuss definite conditions and definite means of cure. No more time need be spent in discussing the possibility or the impossibility of eradicating the contagious social diseases—syphilis and gonococcus infection—than in relating their ubiquity or their influence on all classes of all society. Suffice it to say that rich and poor, intelligent and stupid, moral, immoral, and unmoral, innocent and guilty are paying the price of centuries of an ignorant, ill-considered, false modesty in terms of morbidity and mortality that probably surpass the sum of all other contagious influences combined. If a computation were made of the acute venereal infections, their complications and active sequelæ, the brain and cord lesions, the insanities and idiocies, the inherited and acquired deformities and destructive lesions, the partially and totally blind, the abortions and stillbirths, the operations on the abdomens of the innocent as well as of guilty women, the male and female sterility, the army of infant deaths, the apoplexies, the lowered vitalities of those not manifestly diseased, the moral bias and weakness, and the degeneracies of mind and heart directly or indirectly traceable to the so-called social diseases, there would result a seriousness and perhaps a tendency to reflection throughout humankind that would forecast at least a profound upheaval. The physical results form only the beginning of the influence of the social diseases on the world at large. The broken homes, the divorces, the desertions, the suicides, the incapacity for work, the wages lost, the hospitals and asylums rendered necessary, the cost of treatment, form only a few of the points at which the diseases of immorality impinge on both the innocent and the guilty portions of society. It seems incredible that up to the present syphilis and gonococcus infection are, officially speaking, nonexistent, and that as far as the national, and to a great extent the municipal, authorities are concerned, are deserving only of contempt or complete disregard. In the army and the navy alone are they officially recognized by the Federal Government as diseases. The horde of immigrants that enters this country every year is examined for every infection save these two. The accurate and actual cause is placed on the death certificate the country over in every instance save of these two diseases.

There is before us, therefore, a task to which society at large, and especially the medical portion of it, must straightway address itself. The fact that the problem ramifies in and out through animal passion and private and public immorality renders it more difficult, to be sure, but none the less insistent and none the less finally soluble. Smallpox once appeared hopelessly and permanently beyond control; tuberculosis was only recently regarded with complacent resignation. The social diseases await the same sharp awakening of a people that have been too long asleep and the application of measures that are within our grasp, in spite of all pessimism to the contrary. The practical proposition before us, as an intelligent people, is as follows:

It seems justifiable to estimate that there are approximately 500,000 public prostitutes constantly in the United States, all of whom are infected sooner or later and constantly reinfected with venereal disease. This estimate is based upon the figures of the last census, which records three cities of the first class of over 1,000,000 population. In these, New York, Chicago,[1] and Philadelphia, I estimate roughly (and merely as a basis for argument) about 8,000, 8,000, and 5,000 public prostitutes, respectively, in all 21,000. There are five cities of the second class (100,000–500,000), in each of which we may safely estimate 1,500 public women, except in the case of San Francisco, where the figure is placed at 5,000, making a total of 12,500.

There are 11 cities of the third class (500,000–250,000), in each of which we may perhaps estimate 600 public prostitutes, totaling 6,600. There are 31 cities of the fourth class (250,000–100,000), in each of which we estimate the presence of at least 400 public women, totaling 12,400. There are 59 cities of 100,000 to 50,000 population, in each of which we estimate about 350 public prostitutes, totaling 20,650. There are 120 cities of 50,000 to 25,000 population, in each of which we estimate about 300 public prostitutes, totaling 36,000. There are 2,176 cities below 25,000 population, in each of which we estimate the presence of 200, making a total of 435,200 public women. Adding these figures together we obtain from data that must certainly be regarded as leaning far on the conservative side a total for the country's army of professional prostitutes of at least 544,350. Assume then for a moment that these 544,350 public women earn on an average of $500 annually, a figure far below that which is known to be the average among women of this type. The sum total from such a computation is $272,175,000.

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[1] These figures do not approximate those of the police estimates in New York and Chicago.

Ultraconservative estimate of the number of public female prostitutes and their earnings.

Cities.	Number of public women in each.	Total.
New York, Chicago, Philadelphia	8,000 8,000 5,000	21,000
5 cities of the second class, plus San Francisco (5,000)	1,500	12,500
11 cities of the third class	600	6,600
31 cities of the fourth class	400	12,400
59 cities of the fifth class	350	20,650
120 cities of the sixth class	300	36,000
2,176 cities of the class having under 25,000 population	200	435,200
		544,350

Earnings, $272,175,000. Ultraconservative estimate of average earnings per year, $500.

Estimating three clandestine prostitutes for every one of the 544,350 public prostitutes, there is obtained a total of 1,633,050, probably a low estimate.

Estimating the earnings of each of these as $250 per year, the total obtained is $408,262,500, probably a small portion of the money that actually changes hands in clandestine immorality.

As a matter of fact, there is every reason to believe we are spending on immorality and the social diseases (estimated on the basis of 500,000 public prostitutes and 1,000,000 clandestine prostitutes the latter a ridiculously low estimate), no estimate being included to cover the care of the sick, blind, insane, paralytic, or the expense of infant funerals, not less than $3,000,000,000. At the same time we expend upon the allies of prostitution, intoxicating liquors, $2,000,000,000; tobacco, $1,200,000,000.

We are spending practically nothing of official time or money upon the study and control of the harvestings of these three influences, the first of which is gonococcus disease.

GONOCOCCUS DISEASE.

There is no infectious disease that compares in frequency with gonococcus infection. Thus, there are approximately 500,000 public prostitutes constantly in the United States, all of whom are infected sooner or later and constantly reinfected with this disease. They become permanent foci for the spread of contagion to both the innocent and guilty public.

One of the daily journals has found occasion, in its editorial column, to call in question the accuracy of our statement that there are in this country well over 1,000,000 clandestine prostitutes—namely, those who earn only a portion of their income from immoral practices, and endeavor to maintain an outward appearance of respectability. No one has studied or investigated the conditions in the cities without being speedily convinced that for every public and professional prostitute there are from three to five or more so-called clandestinely immoral girls. No one can fix an accurate percentage covering the immoral element in any factory or mill or department-store population, or any correct number of the office workers or servants or waitresses, or of those who have nothing to do except dress and idle, who accept a return for favors given either in the form of finery, or clothing, or of money itself.

We need not estimate a very large percentage, therefore, of the girls of any one of the myriads of mills and factories and department stores throughout this broad land to total 1,000,000 clandestine prostitutes. To one who knows the 15,000,000 young men and the very many middle-aged and even old men, and the extent to which they prostitute womankind, such an insignificant total as 1,000,000 clandestine prostitutes does not begin to correspond or to include the actual army of more sinned against than sinning girls and women who add to their oftentimes unlivable wages by immoral means after once being forced below the surface by male obliquity and dishonor and by their own weakness in the face of an almost insurmountable temptation.

Probably not one of these clandestinely immoral girls escapes infection with gonococcus disease for more than a brief period. Few, if any, are cured. Very few have the benefit of either diagnosis or treatment until they arrive at the operating table.

If we go still further and name every immoral man a prostitute of either the public or clandestine type we more than double our figures. It is estimated here and abroad that considerably over 50 per cent of young men and boys the country over contract gonococcus disease. This estimate is, in my opinion, very conservative. Of the case histories in one large city hospital the house cases gave 49.9 per cent of the males over 21 years of age admitting gonorrheal infection in their past history and 10.9 per cent as having been infected with syphilis.

Through marriage with the upward of 50 per cent of 15,000,000 American young men who have been infected (many in young boyhood) before maturity with gonococcus disease, very many of our 15,000,000 innocent young girls are infected and brought to the surgeon's table within the first two years of married life.

According to official figures, about the equivalent of a regiment of men are constantly incapacitated by gonorrhea in the United States Army. The percentage is not very different in the Navy. In the factories and mills of America nearly every man has (or has had at some time) gonococcus disease.

The children's wards in hospitals are seldom free for long at a time from epidemics of gonorrhea among little girls.

Approximately one-seventh of all the blind are cases of gonorrheal ophthalmia.

The records of the surgical work in hospitals would indicate that there are constantly no fewer than a million and a half innocent American women the victims of gonococcus disease contracted from their husbands, many of whom were supposedly cured of former infections.

"For the Navy and Marine Corps," writes Surgeon Gates, "the admissions to the sick list for gonorrhea since 1906 have stood first in point of frequency with from 2,085 to 3,015 cases; but these figures greatly underestimate its prevalence, for there was no record of patients not actually disabled. The figures for 1909 show an increase to 5,861." In the Public Health and Marine-Hospital Service in the past 20 years 117,336 cases of gonorrhea were treated, with an annual average of 4,889 cases.

Lieut. Col. Kean, of the Army, says: "We have swiftly retrograded until at present, and for more than a decade, the American Army has maintained a shameful preeminence, in this respect (venereal infection), over the Army at home of any of the great powers." The rate of gonococcus infections per 1,000 mean strength in the Army was 90.52 in 1911. That of all other infectious diseases, excluding venereal, was only 16.744.

As the result of ignoring the relation between the moral and physical health we face the following with respect to syphilis.

SYPHILIS.

"I am reproached with seeing syphilis everywhere." (Ricord.) Gen. Van R. Hoff, U. S. Army Medical Corps, informs us that 73,382 cases of syphilis occurred among the white troops in the Civil War. In the Public Health and Marine-Hospital Service about 1,300,000 patients have been treated in the past 20 years. Of these 106,090 were cases of syphilis, 4,420 constituting the average per year.

Blaschko estimates that 1 in 10 of all the population in Berlin is or has been syphilitic.

Both here and abroad it has been shown by laboratory tests (Wassermann) for syphilis that of 100 public women (prostitutes) examined, from 80 to 90 are syphilitic. Only a few showed open signs of the disease (Dreyer and Meirowsky). Le Pileur found 74 per cent of 431 registered prostitutes syphilitic. Finger, of Vienna, has found 25 per cent of all prostitutes in an actively infectious syphilitic state. This implies the presence of an army of syphilitic immoral women in this country alone, and at least an equal number of innocent syphilitic victims of their husbands' disease contracted from these public women.

A conservative estimate would probably place the number of syphilitics in the United States among the millions. Fournier estimates that one-seventh of the male population of Paris is syphilitic. In many of the European villages 25 per cent of the population is innocently infected, prostitution being in some districts unknown. Citron states that 10 per cent of all the wet nurses in Dresden are syphilitic.

A considerable number of physicians are annually infected in their medical and surgical work. One prominent genito-urinary specialist (Morrow) writes: "More than 50 cases of professional syphilis have come under my observation."

There are 200,000 insane persons in the United States, costing $50,000,000 annually for maintenance, of whom very many owe their mental unbalance to syphilis. In addition, syphilis leads to many of the cases of idiocy and feeblemindedness, marasmus, apoplexy, epilepsy, club feet, hare lip, deaf mutism, blindness, locomotor ataxia, and paresis. These cases are not usually classified as syphilitic, though victims of the disease.

SOCIAL CONDITIONS.

It will be well in passing to consider the social conditions influencing the spread of syphilis and gonococcus disease.

Always and in every instance of prostitution it may be assumed that a clean girl has been assisted if not started on the road to ruin by an unscrupulous or deliberately bad man.

Prostitution, notwithstanding all that has been said to the contrary, is an organized business. It could not live except by the deliberate barter of the bodies and souls of women.

"So unwilling are women to debase themselves that the cadet, the dance hall, the Raines law hotel, false marriages, drink, and even force are necessary to keep the hideous thing flourishing." (Gen. Theodore A. Bingham, ex-police commissioner of New York City.)

Tobacco and alcohol have very often, if not usually, been means of inciting the boy and the girl to practices that were known to be unfair, and then to the complete lowering of the standards of honor and virtue.

The most powerful influence fostering prostitution has been the vicious and unwarranted teaching that the physical health of the male demands a different standard of moral and physical virtue from that of the female. As the result of living this lie for centuries, men have brought women to a state of chronic invalidism and to a social level that is little above that of servants to a sensual male appetite.

Unattractive, injudicious home surroundings, lack of parental comradeship, poverty, the need to toil for small returns, lack of legitimate recreation, these things have driven many a girl from an unintelligent but respectable home into the lap of prostitution.

The love of finery and dress, the opportunity of ready money in return for apparently little expenditure of time and effort, the first excitement of the dissolute life—these things, with home restrictions, often fretfully applied, form the first causes of the lapse from the clean to the immoral life. Probably the temptations furnished by the display in department stores, the dance halls, the cafés, and the theaters, are equally to blame with the utter loneliness and fatigue of the average working girl.

The professional male and female cadet can be found everywhere. In the garb of fashion and elegance, even in that of the minister or deaconness, he and she are to be seen on the lookout for young girls in the stations, the trains, in the stores, at the steamboat landings, even in the country towns. Fifty thousand new, young girls are induced every year to enter the ranks of prostitution in America to fill the places of those who have died.

METHODS OF CONTROL.

As to the methods of control of prostitution, with a view to the eradication of the social diseases:

I would suggest as methods that have not yet been tried out the education of the public, men and women, and even growing boys and girls, in the facts concerning the prevalence, the seriousness, and the means of prevention of the social diseases, syphilis and gonococcus infection, through free distribution by the Federal and municipal authorities, of informing literature, advising the people of the intimate association of prostitution and the social diseases.

More than one State, very recently California, and even New York City, in a restricted measure, have placed syphilis and gonococcus disease upon the list of compulsory reportable diseases. The physician is required to register and report the patient by number, not by name, thus compelling treatment and cure when possible, yet shielding him or her from publicity.

Municipalities should furnish free laboratory diagnoses and free dispensary and ward treatment of the venereal diseases. In the long run these preventive measures would prove a paying investment. Every hospital should be required to maintain free wards for the treatment of syphilis and gonococcus infection.

No method will succeed except the rigid enforcement of the laws preventing public prostitution. Almost every commonwealth provides for the punishment of the owners of property used for immoral purposes, and of those keeping disorderly or immoral houses, and of those committing fornication and adultery. The observance of these laws will prevent very many of the instances of infection with syphilis and gonococcus disease. The contest can then be made purely upon a health basis and will succeed. The following are simple, everyday measures:

The raising (by statute) of the age of consent to 21 years. In one of our States this is at present 7 years, in two it is 10 years, in two 12 years,.in eight 14 years, in only nine is it over 16 years, and in none over 18 years.

The teaching of every young woman that the man who can not offer an absolutely clean moral record is not likely to prove a safe husband and father from the standpoint of transmissible physical disease.

The insistence of the marrying woman upon the submission of a certificate from her own physician vouching for the freedom of her prospective husband from transmissible disease, as far as such freedom can be ascertained. Such diseases should include syphilis, gonorrhea, tuberculosis, epilepsy, and alcoholism, for her own sake and that of her child.

The enactment of a law in every State requiring such a certificate of health from both parties contracting in marriage, prior to the issuance of a license to marry.

The intelligent education of the boys with respect to the invariable infectiousness of the immoral woman and the practical certainty that, if infected, he will transmit his disease to others. The widest possible dissemination of the knowledge that indiscriminate kissing is one of the most prolific means of transmitting venereal disease to innocent persons, especially to and from infants.

The abolishment of the public drinking cup and glass, and the public piece of soap and roller towel.

The insistence by employers upon the furnishing at regular intervals of a physician's certificate of health by all cooks, housemaids, nurse girls, wet nurses, hotel and restaurant waiters, and barbers. One large railroad system at the present time requires the examination at stated intervals of all its train and station restaurant employees on pain of dismissal if the examination is refused.

And finally, the determination of the people that they have in syphilis and gonococcus disease two contagions that can not be dealt with on the basis of mere control. Only eradication will suffice unless failure is anticipated from the beginning. To admit failure in advance is not only a cowardly part, but the surest road to defeat. If the question involves the extermination of prostitution, prostitution must go. The man who advises legalizing or regulating or licensing prostitution in any form indorses the legalized spread of disease. As against these sane measures, aimed at the final ridding of the people of these preventable diseases, we find offered, boldly and without a blush for the effrontery or the open insult to honor among men and women, the reglementation of prostitution. Under its head may be grouped all the methods that have been tried and found wanting.

Almost invariably the argument advanced to justify the further trial and establishment of these antiquated measures consists simply and solely of the claim that in a small regulated district, usually related in some particular way to an especially well-controlled body of troops—like the garrison or Presidio in San Francisco—that among these men and conditions reglementary measures reduce the total incidence of new infections. No one who has studied the subject would venture to deny this assertion. At the same time, we should be allowed the privilege of understanding just what its provisions mean. Sight has been altogether lost, for instance, of the fact that in San Francisco a scant 2,500 are reached out of the total 5,000 and upward of immoral women. The clandestine prostitute is not influenced at all. Meanwhile, the police are subsidized, and the boys and young men of the town and country are deluded into believing that there actually exists that thing which they desire, namely, a safe immorality. The five thousand and upward public women whom they patronize have had no attention whatever paid them. Moreover, at least one-sixth of the entire number of public prostitutes die and must be replaced before each new year by girls from clean homes. Those who tolerate segregation are responsible. All of this presents a strong analogy to the influence of the preventive packet given to soldiers and sailors in the Army and Navy when off duty. There results a small reduction of the annual incidence of venereal disease, but the scheme has only a wicked final value.

The so-called prophylactic or preventive treatment of those intentionally running the risk of infection has in the Army reduced the incidence of venereal infection in 10 years just 5 per 1,000 of mean strength. In 1902 the incidence was 168.08 per 1,000. In 1911 it was 163.49. As illuminating these figures I might also state that in the year following the withdrawal of beer from the canteen in the Army there was (by official figures) a fall of the incidence from 155 to 150. In the year of the establishment of the canteen with beer the incidence had risen among the troops in the country from 81 to 138 per 1,000. These figures hint at the sequence of a real cause and effect. The moral influence of such a measure is eternally bad. It constitutes an admission in advance that the individual soldier or sailor is expected to dishonor some woman, however low she may have been forced by other men who have antedated him—to dishonor some woman, I repeat—and in contracting disease from her to become a public menace; this unless he take immediate precautions, and perhaps even then!

And, as over against this, I ask: Why not for the first time try enforcement of both common sense and the law? Why not attack these diseases with publicity and with a genuine attempt to eradicate the fostering and causal influences through the hygienic purging and sanitation required by other health problems? Why not employ the methods that have approved themselves in other and similar fields? Why turn to procedures that have failed miserably in every instance and in every country in which they have been applied? I answer, it it because men do not wish to relinquish the double standard of morals. It is also because they intend, if it be a possible thing, to continue prostitution and the sale of the souls and the bodies of women! It is because they are winking at the fact that 50,000 new, clean girls are every year needed in this country to take the place of those who die in the ranks of prostitution. It is also because they are willing that woman should remain man's physical and moral inferior and slave. On this principle is based the argument of every contest for the regulation and continuation of vice.

Are we proud of this distinction, or shall we give it short shrift, as unworthy of intelligent and still chivalrous men?

The policy of silence and false modesty with respect to prostitution and its diseases has cost the world more dearly in terms of morbidity and mortality than any other influence or combination of influences. In terms of baby and child lives alone it has paid its way with a ghastly toll.

The European countries are one by one relinquishing police supervision and the medical examination of prostitutes on the ground that by these means and measures both prostitution and the spread of venereal diseases have been furthered.

The licensing of prostitutes has always, through the establishment of confidence in a false safety, increased the danger rather than diminished the number of infections of those with whom these women associate. A public harlot may have been infected within ten minutes after receiving her certificate of freedom from venereal disease. As a matter of fact, modern methods of examination demonstrate that practically every prostitute shows distinct evidence of one or both of the two main venereal conditions, though she may appear well to the observer. Probably a thorough examination would show the same state of affairs in the men who frequent the public houses.

Shall I cite a few authorities upon the question as to whether reglementation does or does not regulate?

The vice commission of Minneapolis asserts: "The position of enforcement of law against prostitution is unassailable."

Lecour, of Paris: "Prostitution is increasing in Paris in spite of the strictest regulation."

Seligman: "An astounding condition of corruption among police officials and direct complicity between the chief of police and the houses of ill fame."

Van Ijsselstein: "I saw that the attendance at the public houses increased as soon as the report spread that I was in charge of the examinations."

Neisser: "The methods actually in use for diminishing the evils of prostitution can not be considered effective."

Blaschko: "In Berlin, in spite of regulation, 20 per cent of the men between 20 and 30 years are infected each year with gonorrhea."

Mireuel: "The more regulated prostitution there is in a country the more prostitution of every kind will develop."

Morrow: "This system (reglementation) has proved to be defective as a sanitary scheme."

And, bearing upon the assertion that segregation does not segregate, I may venture to repeat that there is no large European city, except Hamburg and Bremen, in which segregation now exists as an official measure.

Prostitutes in Europe.

Officially recognized as present in—	Paris.	Vienna.	Berlin.
Police estimate	45,000	30,000	30,000
Registered and regulated	6,000	3,063	2,016

Brieux says through The Girl: "These beastly men give you their foul diseases, and it's me they stick in prison. It's a bit thick, that is."

All prostitutes, clandestine and public, whether segregated or not, acquire acute, and later develop chronic, gonorrhea, not long after entering upon the life of prostitution. I have already stated that modern methods of examination show that almost 100 per cent of public prostitutes have syphilis. Government commissions have reported against the continuance of reglementation, including segregation, in England, France, Germany, Scandinavia, Denmark, Belgium, and Italy.

The vice commission of Chicago concludes: "Constant and persistent repression of prostitution is the immediate method; absolute annihilation the ultimate ideal."

What, then, is to be gained, I ask, by temporizing and by delay? Who has a right to say that prostitution and the social diseases can not be eradicated? A genuine attempt has never been made! Every public prostitute is known by name and address to the police of a given locality for the purpose of collecting a nefarious toll. This demonstration of the power of supervision simply convicts the authorities of an unwillingness, not of the inability, to dominate the situation for the good of the public. On what basis, then, is the demand for the regulation of vice made? Is it (1) that the double standard of moral and physical health is tolerable, either from the standpoint of men or women? or (2) that women constitute a race of beings whom it is justifiable to subject to the sensuality of men? or (3) that it is permissible to allow the two most widespread of all the contagious diseases to be fingered and dallied with, instead of boldly grasped and in due time brought under the same control that has all but exterminated yellow fever and smallpox, at least within the American domain?

I answer that it will not be long before the man who advocates such a craven policy and such a public dishonor will be regarded as unworthy of the title of scientist or physician and will be consigned to an oblivion that swallows all save those who strive for the greatest good of the greatest number, preferring far in advance of selfish male indulgence the health and the lives of our women and children.

WEDNESDAY MORNING, SEPTEMBER 25, 1912.

UEBER TYPHUS-BACILLENTRÄGER.

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Die Kenntnis der Typhus-Bacillenträger reicht etwa ein Dezennium zurück. Im Koch'schen Institut ermittelten 1901 von Drigalski und Conradi, dass Gesunde die Keime Typhuskranker aufnehmen, aber gesund bleiben, obschon die Typhusbacillen im Innern des Körpers sich vermehren und durch Niere sowie Darm abgesondert werden. Diese Beobachtung zeigte, dass wie bei Cholera, so auch bei Typhus die Krankheitserreger unter bestimmten Voraussetzungen ihre krankheitserregende Fähigkeit ablegen. Zugleich forderte der neue Befund dazu auf, nach Ausbruch von Typhus die gesunden Angehörigen und Hausgenossen bakteriologisch zu untersuchen. Solcher Aufgabe unterzog sich zuerst die ärztliche Studiencommission (Frosch, von Drigalski, Jürgens und Conradi), die 1902 unter der Aegide von Robert Koch die Bekämpfung des Typhus im Regierungsbezirk Trier in Angriff nahm. Ihre Arbeiten lieferten wichtige Beiträge zur Contagiosität des Typhus, sie erwiesen die epidemiologische Bedeutung der larvirten sowie abortiven Typhuserkrankungen und machten bereits die Annahme einer chronischen Verlaufsweise der Typhusinfektion wahrscheinlich. Sichergestellt wurde jedoch der chronische Typhus durch die Untersuchungen von v. Drigalski, Dönitz, Lentz, Forster und seiner Schüler, sowie von Conradi. Die nähere Kenntnis dieser Erscheinungsform geht insbesondere auf J. Forster und seine zahlreichen Mitarbeiter, sowie auf Dörr zurück. Doch erscheint der Hinweis angebracht, dass die experimentelle Feststellung des chronischen Typhus 1891 bereits amerikanischen Forschern Blachstein und W. H. Welch gelang.

In den letzten 10 Jahren ist insbesondere durch die systematische Arbeit der organisierten Typhusbekämfung im Südwesten Deutschlands ein umfangreiches casuistisches und statistisches Material über die Typhusbacillenträger beigebracht worden. Dennoch erscheint der Zeitraum noch zu kurz, um in allen Einzelheiten ein abschliessendes Urteil über Ursachen und Folgen der chronischen Typhusinfection zu ermöglichen. Immerhin kann der Versuch unternommen werden, in grossen Zügen wenigstens das Bild der Typhusbacillenträger nach dem gegenwärtigen Stand des Wissens aufzuzeichnen.

In früherer Zeit wusste man nur, dass Kranke und Reconvalescenten mit ihren Excreten Typhuskeime entleeren. Nun aber steht fest, dass neben den Krankwerdenden und Genesenden vor allem Gesunde und Nichterkrankte die Infectionskeime ausscheiden. Personen, die nach Ueberstehen der Krankheit jahrelang Typhuskeime absondern, nannte man "Dauerausscheider," "Bacillenträger" jedoch solche Individuen, die Typhuskeime aufnehmen und abgeben, aber gesund bleiben. Diese von Martin Kirchner herrührende Begriffsbestimmung erscheint immer mehr unhaltbar. Einmal nämlich hebt die Bezeichnung "Dauerausscheider" die begriffliche Bedeutung der Zeit ungebührlich hervor, während das tatsächlich unterscheidende Merkmal gegenüber dem Bacillenträger, der Krankheitsablauf, unberücksichtigt bleibt. Ferner kennt man ja bereits nichterkrankte Bacillenträger, die dauernd Typhuskeime eliminiren. Darum empfiehlt es sich mit diesen verwirrenden Begriffen aufzuräumen und an ihrer Stelle folgende Unterscheidungen zu treffen. "Typhus-Bacillenträger" sind gesunde Personen, die Typhuskeime absondern. Wir teilen nun die Gruppe der Typhus-Bacillenträger ein in "Hauptträger" und "Nebenträger." Hauptträger sind die Typhus-Bacillenträger, die früher typhuskrank gewesen waren, Nebenträger diejenigen, die niemals objektive oder subjektive typhöse Krankheitsanzeichen darboten. Weiterhin kann man je nach der Absonderungsdauer der Typhusbacillen transitorische und chronische Haupt- und Nebenträger unterscheiden, doch gibt es hier fliessende Uebergänge. Unser Einteilungsprinzip gründet sich auf die Erfahrung, dass die Krankheitsübertragung bei Typhus im wesentlichen von Personen ausgeht, die am Typhus erkrankt waren. Individuen jedoch, die nie typhuskrank waren, sondern aus vollem Wohlbefinden heraus Typhuskeime absondern, sind wohl Bacillenüberträger, aber in der Regel keine Krankheitsüberträger. So verstehen sich leicht Begriffe Hauptträger, worunter die früher an Typhus erkrankten Keimträger verstanden werden, und Nebenträger, jene meist harmlosen, von jeglicher Gesundheitsstörung verschont gebliebenen Bacillenträger. Obschon die Nebenträger vorübergehend mit Faeces und Urin Typhuskeime absondern, und obgleich diese gesundbleibenden, typhusinficirten Personen frei sich bewegen und der gewohnten Tätigkeit ungehindert nachgehen, so ist doch bisher kein einwandfreier Fall einer Krankheitsübertragung durch Nebenträger bekannt geworden. Wir werden daher zur Annahme hingedrängt, dass die Nebenträger an der Verbreitung des Typhus keinen wesentlichen Anteil nehmen.

Das epidemiologische Interesse wendet sich demnach vornehmlich den Hauptträgern zu, und es gilt nun, deren Wesen und Bedeutung in Umrissen zu kennzeichnen. Die nachstehenden Ausführungen stützen sich im wesentlichen auf die grundlegenden Untersuchungen von J. Forster. Die Wesenseigenschaft des Hauptträgers besteht darin, dass bei einem Individuum die Typhuserkrankung aufhört, die Typhusinfection aber fortbesteht. Diese chronische Typhusinfection währt entweder Monate und Jahre oder endigt erst mit dem Tode. Sicher erkennbar ist die chronische Typhusinfection lediglich durch bakteriologische Untersuchung. Das völlige Wohlbefinden des Hauptträgers, sowie der objektive klinische Befund geben keinerlei Hinweis, dass der ehemals Typhuskranke im Organismus Typhuskeime aufspeichert und ihre Culturen entwickelt, sodass Milliarden von Typhusbacillen seinen Körper verlassen und Haus und Hof gefährden. Gewisse Anhaltspunkte für das Vorliegen einer chronischen Typhusinfection gibt allerdings bisweilen eine sorgfältig erhobene Anamnese. Die Angaben, dass früher oder gegenwärtig Gallensteinbeschwerden bestanden, dass ferner öfters Darmstörungen, Verstopfung oder Durchfall sich einstellen, bieten wenigstens Verdachtsmomente. Was zunächst die Dauer der chronischen Typhusinfection angeht, so ist gegenwärtig nur erwiesen, dass sie mindestens 10 Jahre anhält. Sehr wahrscheinlich aber ist es, dass auch meist in jenen zahlreichen Fällen, bei denen die Typhuserkrankung weit länger zurückliegt, neuerdings aber erst eine chronische Ausscheidung von Typhuskeimen beobachtet wurde, eine mehrere Dezennien währende chronische Typhusinfection vorliegt. Immerhin darf nicht die allerdings seltene Tatsache geleugnet werden, dass ehemals Typhuskranke nach Jahr und Tag einer Superinfection unterliegen, die infolge der erworbenen Immunität eine chronische Typhusinfection veranlasst. Auf jeden Fall muss damit gerechnet werden, dass unter Umständen ein Typhuskranker wohl die Krankheitserscheinungen, nie aber die Krankheitserreger, mehr los wird. Der Prozess der Genesung täuscht nur darüber hinweg, dass aus dem Gesundeten ein lebenslänglicher Träger von Typhuskeimen hervorging. Die Ausscheidung von Typhuskeimen durch die Hauptträger kann nun in unregelmässiger und unbeständiger Weise erfolgen. Perioden mit täglicher Absonderung zahlloser Typhusbacillen werden abgelöst von Zeiten, innerhalb deren überhaupt keine Typhuskeime in den Excreten nachgewiesen wurden. Ja, es sind Fälle chronischer Typhusinfection beschrieben worden, bei denen jahrelange Intervalle zwischen den einzelnen Befunden von Typhuskeimen festgestellt wurden. Hier indess erscheint es wahrscheinlicher, dass Neuinfektionen hinzukamen. Allein keinem Zweifel unterliegt es, dass tatsächlich bei Hauptträgern die Ausscheidung von Typhusbacillen monatelang aussetzt, wieder beginnt und auf's neue sistiert, sodass nur mit grösster Vorsicht ein Erlöschen der chronischen Typhusinfection behauptet werden darf. Zudem fehlt es noch an Mitteln, die chronische Typhusinfection im Stadium der Latenz zu erkennen. Daher entziehen sich zahlreiche Hauptträger der Ermittlung und wirken ungehemmt in der Stille fort, weil die bakteriologischen Untersuchungen in die Zeit der freien Intervalle hineinfielen. Die Periodizität der Absonderung erschwert in hohem Masse die Ermittlung der Hauptträger und zugleich die Prophylaxis.

Wir wenden uns nun den Wegen zu, auf denen die Typhuskeime den Körper des Hauptträgers verlassen. Hier kommen im wesentlichen nur die Absonderungen der Niere und des Darms in Betracht. Eine ganz besondere Gefahr bildet der Harn des Hauptträgers. Schon Petruschky machte seinerzeit darauf aufmerksam, dass 1 ccm. Harn eines Typhuskranken über 150 Millionen Typhuskeime enthalten kann. Den gleichen Ziffern begegnen wir auch bei den Hauptträgern. Vergegenwärtigt man sich nun, dass solche Individuen frei herumgehen und unter ländlichen Verhältnissen *sub divo* den Harn absetzen, dass ferner flüssige Bestandteile leichter und unmerklicher als feste Stoffe verschleppt werden, dass endlich die Harnentleerung häufiger erfolgt, als die Defaecation und überdies beträchtlichere Mengen zu Tage fördert, so dürfte einleuchten, dass auch bei Hauptträgern insbesondere der Harn die Ausstreuung des Contagiums bewirkt. Der Befund von Typhuskeimen wird hier sowohl bei klarem und trübem, bei einweissfreiem und eiweisshaltigem Harn erhoben. Ihr Nachweis wird wesentlich erleichtert durch das Fehlen störender Begleitbakterien. Allein die ausschliessliche Absonderung von Typhuskeimen durch den Harn seitens der Hauptträger muss als ein relativ seltenes Ereignis angesehen werden. Weit häufiger erfolgt die Ausscheidung der Typhusbacillen gleichzeitig durch Urin und Faeces. In den Faeces des Hauptträgers finden sich häufig die Typhusbacillen ständig nahezu in Reinkultur. Indess in anderen Fällen wechselt der Keimgehalt ausserordentlich rasch, bald werden zahllose, bald nur spärliche Typhuskeime mit den Faeces ausgeschieden. Nicht selten erfolgt ferner die Absonderung von Typhusbacillen periodisch, sodass unter Umständen erst nach Monaten die Krankheitserreger im Stuhlgang wieder erscheinen. Allerdings ist es möglich, dass hier bisweilen spärliche Typhuskeime übersehen werden, weil gegenwärtig anreichernde Züchtungsverfahren nicht zur Verfügung stehen.

Es erhebt sich jetzt die Frage nach der Pathogenese der chronischen Typhusinfection. Die experimentelle Forschung der letzten Jahre führte den zwingenden Beweis, dass der Abdominaltyphus keineswegs, wie die Leichenbefunde lehrten, als eine Erkrankung des Darms aufzufassen sei, sondern als eine primäre Bakteriämie, eine Allgemein-Infection, die secundär erst die Schleimhaut des Dünndarms in Mitleidenschaft zieht. Indem nun der vom Typhus ergriffene Organismus sich der im Blute kreisenden Typhusbacillen und ihrer Toxine durch Ausscheidung in Harn und Galle zu entledigen sucht, werden gerade Niere und Leber auf doppelte Weise geschädigt.

Einmal nämlich bedingt die Einwirkung des Typhus-Toxins auf das Parenchym diffuse trübe Schwellung, sowie diffuse fettige Entartung, und diese zellulären Veränderungen gehen mit erhöhter Durchlässigkeit des Drüsengewebes einher. Zweitens aber bilden sich in Niere und Leber infolge Anhäufung der in den Blutstrom eingedrungenen Typhusbacillen embolische Herde aus, die in Abzessbildung übergehen können. Auch in anderen Organen, beispielsweise in Milz, Knochenmark, Prostata und den Samenblasen wurden, allerdings seltener, zur Vereiterung hinneigende Typhusbacillen-Herde aufgefunden. Wenn nun derartige embolische Herde in der Niere oder auch in der Prostata persistieren, so ist die chronische Ausscheidung von Typhusbacillen durch den Harn die unabwendbare Folge. So erklärt sich auch bei ehemals Typhuskranken die bereits erörterte ausschliessliche Absonderung von Typhusbacillen durch den Harn.

Noch nicht völlig klar gestellt in ihrer Pathogenese indess ist die chronische Ausscheidung von Typhusbacillen durch den Darm. Sicher erwiesen ist nur, dass in der Regel die in dem Faeces enthaltenen Typhuskeime durch den Gallenzufluss in den Darmkanal gelangt sind. Die infizierte Galle also ist es vor allem, die bei Typhusbacillenträgern und ebenso bei Typhuskranken die Contagiosität des Darminhalts bedingt. In welcher Weise nun die Galle Typhuskeime aufnimmt, darüber herrscht noch keine völlige Einhelligkeit. Unbestritten ist hier nur die Tatsache, dass stets von dem Blutweg her die Typhuskeime in die Galle eindringen und innerhalb der Gallenwege sich einnisten. Ob aber der Austritt der Typhusbacillen aus dem Blut im Bereich der Leber oder erst in der Gallenblase sich vollzieht, ist noch nicht hinreichend geklärt. Wohl besteht die Möglichkeit, dass toxisch entartete Leberzellen oder auch embolische Herde der Leber den direkten Uebergang der Typhuskeime in die Gallencapillaren gestatten. Indes sprechen die bekannten Versuche von Josef Koch und Chiarolanza dafür, dass vornehmlich in der Wandung der Gallenblase embolische Herde sich entwickeln, und demnach die Infection der Galle erst innerhalb der Gallenblase zustande kommt. Wie dem auch sein möge, die Tatsache jedenfalls steht unverrückbar fest, dass insbesondere die Gallenwege den Dauersitz der Typhuskeime im Organismus des Hauptträgers bilden. Seit langem bekannt und durch die Beobachtungen von Forster und Kayser, sowie von Dörr, in den Vordergrund gerückt, sind die typhösen Veränderungen der Gallenblase. Die Cholecystitis typhosa stellt eine garnicht seltene Folgeerscheinung der Typhuserkrankung dar. In der Tat ist es zweifellos, dass die typhöse Schleimhautentzündung der Gallenblase aufs Beste der ständigen Ansiedlung und Vermehrung der Typhusbazillen Vorschub leistet. Geht nun dieser acute Prozess in den chronischen Zustand über, dann sind für die Persistenz der Typhusbacillen alle Voraussetzungen gegeben.

So wird in zahlreichen Fällen chronischer Typhusinfection die Gallenblase zum Vegetationsort der Typhusbacillen. Besondere Hilfsmomente kommen dem zu statten. Haben sich nämlich bereits vor Ausbruch des Typhus Gallensteine in der Gallenblase gebildet, dann findet der Typhuskeim eine für die chronische Infection besonders geeignete Stätte vor. Denn der ständige Fremdkörperreiz unterhält hier die Entzündung. Da nun, wie die Statistik aufweist, ca. 5 Prozent aller Menschen von Gallensteinen befallen werden, und unter diesen Trägern von Gallensteinen nur ein Bruchteil etwa ein zehntel, klinische Erscheinungen darbietet, so muss damit gerechnet werden, dass die Typhuserkrankung gar nicht selten Individuen befällt, die beschwerdelos Gallensteine mit sich führen. Solche Personen sind prädisponiert, nach Ablauf ihres Typhus dauernd Typhusbacillen mit dem Stuhlgang auszuscheiden. Dass lediglich die Anwesenheit von Typhusbacillen in der Gallenblase die Gallensteinbildung auslösen könnte, dafür steht der Beweis noch aus. Hingegen erscheint es nicht ausgeschlossen, dass auch diejenigen Faktoren, die zur Bildung der Gallensteine beitragen, Zustandsänderungen der Gallenblase bedingen, die der Entwicklung einer chronischen Typhusinfection förderlich sind. Vielleicht kommt hier die Stauung des Gallenabflusses in Betracht, die mechanisch durch Druck des Corsetts, sowie auch durch Gravidität entstehen soll. In diesem Zusammenhang mag auf die Tatsache hingewiesen werden, dass bei Frauen chronische Typhusinfectionen und ebenso auch Gallensteinleiden weit häufiger auftreten als bei Männern. Vor zu weitgehenden Analogieschlüssen indess schützt die Erkenntnis, dass ausser der Gallenblase, die Gallenwege, ferne Leber, Niere, Milz, Knochenmark und Prostata mit ihren embolischen Herden für die Entstehung und Fortdauer der chronischen Typhusinfection verantwortlich gemacht sind. Zusammenfassend muss betont werden, dass die chronische Ausscheidung von Typhusbacillen durch den Darm vornehmlich auf eine die Typhuserkrankung überdauernde Infection der Gallenwege, die chronische Absonderung der Typhuskeime durch den Harn auf embolische Herde der Niere zurückgeht. Die vorausgegangenen Ausführungen über die Pathogenese der chronischen Typhusinfection finden ihre Bestätigung in dem allerdings nur spärlichen bislang vorliegenden Sectionsergebnissen bei Bacillenträgern. Indess ist zu erwarten, dass späterhin ein umfangreicheres Obduktionsmaterial die vorgetragenen Anschauungen ergänzen, vielleicht sogar umgestalten wird.

Wir treten jetzt in die Erörterung ein, auf welche Weise die chronische Typhusinfection ermittelt werden kann. Bei dem Fehlen klinischer Merkmale sind wir hier ausschliesslich auf die bakteriologische Untersuchung angewiesen. Die chronische Ausscheidung von Typhuskeimen durch Urin oder Faeces kann nur durch kulturelle

Züchtung der Erreger mit Sicherheit festgestellt werden. Neben dem einfachen Ausstrichverfahren auf dem von Drigalski-Conradischen Nährboden, der Endo-Platte, dem Padlewski-Agar, dem Conradischen Brillantgrün-Pikrinsäureagar hat sich die Abschwemmung der Löffler'schen Malachitgrün-Platte nach Lentz-Tietz bestens bewährt. Wie bereits ausgeführt, sind aber negative Resultate bei Bacillenträgern nur mit aller Vorsicht aufzunehmen, weil die Absonderung der Typhuskeime unregelmässig und unbeständig vor sich geht, ganz abgesehen davon, dass Material-Unterschiebungen bei der mangelnden Controlle unausbleiblich sind.

Nächst dem Züchtungsverfahren kommt die Gruber-Widalsche Reaktion in Betracht. Nach den bisherigen Erfahrungen kann man annehmen, dass rund $\frac{4}{5}$ aller Hauptträger mindestens in einer Serumverdünnung von 1:100 Typhusbacillen agglutiniren. Bei älteren Personen, deren Typhuserkrankung jahrelang zurückliegt, darf daher der positive Ausfall der Gruber-Widalschen Reaktion als ein Verdachtsmoment für das Vorliegen chronischer Typhusinfectionen angesehen werden. Bei Durchsuchung ganzer Ortschaften, wie überhaupt bei Massenuntersuchungen gewährt die Gruber-Widalsche Reaktion zum mindestens Anhaltspunkte, bei welchen Personen auf Typhuskeime in Urin und Faeces zu fahnden ist.

Inwieweit die Bestimmung des opsonischen Index zur Auffindung von Hauptträgern beiträgt, darüber lässt sich noch nichts sicheres sagen. Nach den bisherigen spärlichen Untersuchungsergebnissen, hat es den Anschein, als ob bei chronischer Typhusinfection eine Erhöhung des opsonischen Index eintritt. Weitere systematische Untersuchungen müssen hier Aufschluss geben.

Schwankende Ergebnisse zeitigte bisher das Complement-Bindungsverfahren. Indess ist bei dem fragmentarischen Material ein abschliessendes Urteil nicht möglich.

Nunmehr wenden wir uns der Fragestellung zu, ob und inwieweit Krankheitsübertragungen von den früher an Typhus erkrankten Bacillenträgern ausgehen. Auch der hyperkritische Skeptiker muss jetzt ohne Vorbehalt einräumen, dass in den Hauptträgern allein die letzte Ursache des endemischen Typhus zu suchen ist. In allen Zonen und Ländern, wo immer endemisch der Typhus herrscht, sind die dauernd Typhuskeime ausscheidenden Hauptträger aufgefunden worden. Von überall her ist im Laufe der letzten Jahre ein die Frage erschöpfendes kasuistisches Material beigebracht worden, und alle diese Einzelbeobachtungen laufen stets darauf hinaus, dass aus dem versteckten Depot eines Typhusbacillenträgers, der ehemals krank war, zahlreiche um Monate oder Jahre auseinander liegende, scheinbar sporadische Typhusfälle ihren Ausgang nahmen. Wurde der schuldige Hauptträger entfernt, so hörten die Seuchenfälle auf. Ganz eindeutig sind die zahlreichen Beobachtungen, die innerhalb geschlossener Anstalten, in Kasernen, Internaten, Krankenhäusern, und Irrenanstalten erhoben worden sind. Erst die mühselige Auffindung und vollständige Isolierung der Hauptträger bereitete hier den zuvor immer wiederkehrenden Typhusausbrüchen ein rasches Ende. Aber auch in der frei lebenden Bevölkerung gelang es in überaus zahlreichen Fällen chronisch Typhusinficierte aufzuspüren und ihrem verderblichen Wirken Einhalt zu gebieten. Ferner wurde durch die Ermittlung unbekannter kontagiöser Hauptträger das früher rätselhafte Auftreten gehäufter Typhuserkrankungen in Typhushäusern restlos aufgeklärt. Endlich konnte auch die Typhusendemie ganzer Ortschaften auf die in der Stille wirkende Contagiosität vereinzelter Hauptträger zurückgeführt werden. Die von der organisierten Typhusbekämpfung im Südwesten Deutschlands planmässig durchgeführten Massenuntersuchungen innerhalb endemischer Typhusortschaften förderten nämlich eine ganze Anzahl latenter chronischer Typhusinfectionen zu Tage, und durch diese Erhebungen wurde es möglich, in diesen Orten sämtliche zuvor ungeklärten und anscheinend zusammenhanglosen Neuerkrankungen der letzten Jahre lückenlos genetisch aneinander zu reihen. Diesen Beobachtungen kommt wohl allgemeinere Bedeutung zu. Das vorliegende Tatsachenmaterial drängt zu der Anschauung hin, dass die Typhusendemie von Stadt und Land auf die verborgene krankheitserregende Fähigkeit der Hauptträger sich gründet. Die Statistik, die über die Gefahrgrösse der chronisch typhusinficierten Hauptträger aufgestellt worden ist, gibt nur ein unzulängliches Bild. Selbst die ungewöhnlichen Mittel und Hilfskräfte der organisierten deutschen Typhusbekämpfung haben es noch nicht dahin gebracht, im Bekämpfungsgebiet alle Hauptträger ausfindig zu machen. Wenigstens bleibt hier eine beträchtliche Zahl von Neuerkrankungen unaufgeklärt, und es erscheint wahrscheinlich, dass ein Teil dieser nicht aufgehellten Typhusfälle unbekannt gebliebenen Hauptträgern zur Last zu legen sei. Daher erscheint es auch verfrüht, auf die statistischen Ziffern näher einzugehen und anzuführen, wieviel Typhuserkrankungen direkt oder indirekt auf chronisch typhusinficirte Personen zurückgehen. Wichtiger erscheint es, der Tatsache Erwähnung zu tun, dass die chronische Typhusinfection fast durchgehends erwachsene Personen befällt. Mit zunehmenden Lebensalter steigt auch die Kurve der chronisch Typhusinficierten. Von epidemiologischen Interesse ist es ferner, exakt festzustellen, in welcher Häufigkeit die chronische Typhusinfection auftritt. Soviel man bisher weiss, bleiben von Hundert Typhuskranken fünf chronisch inficirt. Endlich ist es von Belaug, dass sich nach den allerdings noch lückenhaften Feststellungen im Gebiet der deutschen Typhusbekämpfung unter den Hauptträgern 4 mal soviel Frauen als Männer befinden. In endemischen Typhus-Ortschaften muss daher die bakteriologische Untersuchung insbesondere die Frauen berücksichtigen. Die allerdings nur hypothetischen Gründe für dieses Verhalten worden bereits erörtert.

Bevor wir unsere Ausführungen beschliessen, sollen noch die Abwehrmassnahmen besprochen werden, die gegenüber den gefährlichen Hauptträgern zu ergreifen sind. Leider sind wir vor der Hand ausserstande, durch interne Mittel, die chronische Typhusinfection zum Erlöschen zu bringen. Daher ist auch die Zahl der empfohlenen Desinficientien Legion. Die Schwierigkeit, auf chemotherapeutischem Wege vorwärts zu kommen, liegt darin, dass die in Niere und Leber zerstreuten Typhusbacillenherde von vornherein schwer zugänglich und angreifbar sind. Auch meine früheren systematischen Versuche, bei acuter und chronischer Typhusinfection, eine Abtötung der Typhuskeime zu erzielen, haben bisher bei Versuchstieren, nicht aber bei Menschen merkliche Erfolge erzielt. Auch die Fortsetzung dieser Versuche im Kaiserlichen Gesundheitsamt verlief bislang ergebnislos. Unsichere Resultate brachte ferner die chirurgische Entfernung der Gallenblase. Da die chronische Typhusinfection nicht nur die Gallenblase, sondern auch die Gallenwege in Mitleidenschaftzicht, muss natürlich die Cholecystotomie häufig im Stich lassen, ganz abgesehen davon, dass die Gefährlichkeit des Eingriffs allgemeinere Anwendung verbietet. Auch die Vaccination versagte. Unter diesen Umständen muss vor der Hand von einer Therapie der Bacillenträger abgesehen werden. Es verbleiben somit nur die bekannten, auf Isolierung und Desinfection hinzielenden Bekämpfungsmassnahmen, deren Durchführung in der Regel nur in bescheidenem Masse zu erwarten ist. Eine dauernde Isolierung der Hauptträger lässt sich überhaupt nur innerhalb geschlossener Anstalten in Krankenhäusern oder Irrenanstalten erreichen. Bei chronisch typhusinficirten Geisteskranken insbesondere muss eine völlige Absperrung gefordert werden. Innerhalb der freibleibenden Bevölkerung aber ist eine solche Massregel unausführbar. Das einzige was hier geschehen kann, *ut aliquid fiat,* ist die ständige Ermahnung zur Sauberkeit und Vorsicht. Desinfectionsmassnahmen sind gleichfalls anzuraten, und zwar in gleicher Weise wie bei Typhuskranken. Eine peinliche Befolgung dieser Prophylaxis aber kann nur von solchen Personen erwartet werden, deren soziales Gewissen geschärft ist. Wer 8 Jahre lang im Dienst der Seuchenbekämpfung gestanden hat, gibt sich in diesem Punkt keinen Illusionen mehr hin. Peinliche Schwierigkeiten können sich ergeben, wenn chronische Bacillenträger mit der Herstellung und Zubereitung oder dem Verkauf von Nahrungstmitteln befasst sind. Das öffentliche Interesse fordert mit Recht ihre Entfernung aus diesen Betrieben. Darüber leidet aber das wirtschaftliche Interesse der Bacillenträger Not. Es ist hoffentlich nur eine Frage der Zeit, dass die Entschädi-

gungspflicht gegenüber materiell geschädigten Bacillenträgern vom Staate anerkannt wird, sofern seine Massnahmen eine wirtschaftliche Einbusse herbeiführten. Wir stellen nicht in Abrede, dass die angeführten Bekämpfungsmassnahmen gegenüber den Typhusbacillenträgern keinen sicheren Erfolg versprechen. Allein die Ursachen des endemischen Typhus liegen jetzt klar vor Augen. Nun gilt es, aus der theoretischen Erkenntnis die praktische Nutzanwendung zu ziehen. Es ist eine dringliche Aufgabe der Chemotherapie, die chronische Typhusinfection des Menschen zu heilen. Die Erreichung dieses Zieles sichert die Ausrottung des endemischen Typhus.

THE CARRIER PROBLEM IN TYPHOID FEVER, PARATYPHOID FEVER, DIPHTHERIA AND BACILLARY DYSENTERY.

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Here is not the occasion for an exhaustive review of the carrier question, before an audience of public health experts, for however pressing the administrative issues may be, the main facts regarding the prolonged vegetation of specific microorganisms in the convalescent and in the exposed but apparently clinically uninfected person, must now be considered as generally known.

At the last meeting of this congress, in 1906, a considerable amount of attention was directed to the carrier, more particularly in relation to enteric fever and cerebrospinal meningitis—an attention which had been aroused mainly by the work of the typhoid campaigners in southwest Germany in carrying out the precepts of the late Robert Koch, and by the bacteriological findings in the course of the Silesian epidemic of cerebrospinal meningitis of 1904–5. The diphtheria carrier was then no new phenomenon, but the problems connected with him remain still to a very large extent unsolved. In cholera and bacillary dysentery the importance of the carrier has only been fully realized within the past few years, and evidence is already accumulating which at least suggests that in other epidemic diseases, for example, in epidemic poliomyelitis, the human carrier may act as a focus of infection.

In fact, it may now be said that the part played by human carriers in the spread of infectious diseases is on all sides gaining wider recognition, and the problem of dealing effectively with these sources of infection has already become of prime importance, not only to the administrator of public health, but also to the experimental pathologist and bacteriologist. It is primarily to the labors of the latter that our present knowledge of the carrier-status is due, and although on the epidemiological side a few dissentient voices have been raised in protest against the attachment of undue importance to the human carrier, the great majority of public health administrators have welcomed the new knowledge, and are eagerly calling on the bacteriologist to give them a further lead. It is recognized that a human carrier who has been proved to be a source of infection can not be dealt with in the same drastic fashion as an inanimate and probably innocent fomes, consequently it has now become the urgent duty of the administrator to institute appropriate measures for the control of carriers, and, on the other hand, of the experimental worker, to devise methods for the efficient prevention and cure of the carrier condition.

With this ever-increasing knowledge of the prolonged vegetation of specific germs in the organism of certain persons who have survived the infection, has come an ever fuller recognition of the fact that the scope of the term infection is exceedingly difficult to define. Bacteriological research in the course of recent epidemics of enteric fever, diphtheria, cerebrospinal fever, and cholera has shown that the clinical manifestation of an infection may vary from the typical description of the text book to the very minimal dimensions which possibly only serological analysis can reveal.

In typhoid fever, for example, to which my remarks will first be directed, two fairly distinct types of carrier have been shown to be potent in the spread of infection, viz, the transitory carrier, whose infection has been either clinically typical or so slight as to be completely overlooked, and the chronic carrier, whose infectivity in domestic, institutional, and milk-borne outbreaks has time and again been proved beyond question. Specific instances of such capacity to infect would be out of place here. In recent years they have accumulated so rapidly that the view is becoming more and more prevalent that in the last instance the carrier is the elemental source of infection and, therefore, the person to be unremittingly searched for and, when found, brought under administrative control. In a report on the enteric fever carrier which I made to the English Local Government Board 18 months ago, numerous striking instances of the infectivity of carriers collected from all sources were detailed, and even these made no claim to be exhaustive.

What I would discuss particularly here is not so much the actual evidence of infectivity of typhoid carriers, but rather the c rrect appraisement of their influence as contrasted with that of other more immediate sources of infection. When extensive studies are made into the etiology of typhoid outbreaks, particularly in endemic foci, e. g., in the German campaign area, it is found that the proportion of cases of enteric fever traceable to carriers may rise as high as 50 or 60 per cent of the explained cases. It is the chronic carrier who forms the first link in a chain of cases, while the transitory carrier, whose infection may be abortive, and the precocious carrier, whose symptoms have not yet set in, are very potent factors in the further spread. In the interests of preventive medicine, the chronic carrier has the first claim on our attention, as it is this type of carrier who is immediately responsible for the recrudescence of infection, whether in endemic or explosive outbreaks.

Many of these chronic carriers are now known and located, as the result of investigations into such outbreaks, and not a few of them have again proved their infectivity, owing to the neglect of the hygienic precautions they were recommended to take. This latter fact, viz, that a declared carrier may again initiate infection, is one of the strongest arguments that may be used in reply to the captious epidemiological critic who maintains that the carrier makes his or her appearance on the scene only after a case or cases of infection have occurred.

It can not be too strongly urged that in attempting to estimate the influence of carriers in the spread of enteric fever, due regard must be paid to the selection of the material, and the care with which it has been investigated. Certain detailed investigations in the German campaign area afford very convincing evidence of the important rôle played by the carrier. Of these I would refer to the experience of Brückner, who has recently analyzed the epidemiological and bacteriological data with regard to typhoid outbreaks in Saarbrücken, for the year 1911. There were 28 epidemic groups, each containing not less than 6 cases and occasionally as many as 69 in each. These chains of cases were in 14 instances traceable to typhoid-sick persons, and, in the other 14 cases, to carriers. Many of these carriers also were declared carriers. The vehicle by which infection was conveyed from the carrier to the attacked was, in a surprising number of cases, milk and other foodstuffs (e. g., vegetables and the like). Brückner's results, in fact, bear out most clearly those obtained by Kayser, whose experience in Strassburg was that enteric fever is largely an infectious disease produced by infected foodstuffs.

Of these channels of infection, milk is perhaps the most important, and there can be no question that these milk-borne outbreaks associated with carriers afford perhaps the most trenchant evidence of the infectivity of the carrier.

I would refer to the extraordinary series of cases in Folkestone which Johnstone, of the English Local Government Board, found to be attributable to milk infected by one single carrier working on dairy farms. It was found that 64 per cent of the cases of enteric fever infected in Folkestone during the period 1896–1909 had been supplied with milk from farms on which this one carrier was employed.

Other extensive milk-borne outbreaks in England associated with carriers have been reported by Stott, Carnwath, and others, and in America also not a few notable outbreaks of a similar character have been recorded by Bolduan and Noble, Jordan and Irons, Lumsden and Woodward, Rosenau, Lumsden and Kastle, and others.

Not only milk sellers and dairy workers but also sellers of meat, vegetables, fruit, and, in fact, all kinds of foodstuffs, have been shown to be potent distributors of infection, in cases where the vendors happen to be enteric carriers.

In institutions and, more particularly, lunatic asylums in Germany and Great Britain, the presence of carriers has, in a surprisingly large number of instances, been found to constitute the prime source of recurrent typhoid outbreaks, which have ceased immediately on the isolation of the declared carrier or carriers. There is no need to multiply cases of the kind at this stage. The conclusion is obvious that in the spread of enteric fever the carrier occupies no subordinate position, but that, in fact, in the last instance the blame must rest on the chronic carrier, and there is good evidence for formulating the aphorism "No carriers, no typhoid fever." The converse of this statement of course does not hold, as it is obvious that the potential infectivity of the carrier depends to a large extent on his knowledge of his condition and more especially on his personal hygiene. There is no necessity to labor this point, but it should be very clearly understood that the dangerousness of the carrier is largely a function of these two factors.

I now come to a brief consideration of the measures which have been taken toward a solution of the problem of the cure and control of enteric carriers.

If we could rid the carrier of his bacilli, we could insure ourselves against further infection proceeding from that carrier, and consequently any administrative control of declared carriers would be rendered superfluous. So far that desideratum is far from being attained, but success is only likely to be achieved by intensive studies of the experimental carrier condition in laboratory animals—a form of study which was initiated many years ago by Blachstein and Welch in this country and, in the light of the carrier problem, is now being actively pursued by workers in many laboratories.

So far as published experiments in this connection are concerned, it does not appear that we have yet found a chemotherapeutic remedy which is likely to be satisfactory in the treatment of human carriers. The experiments of Morgan and others go to show that spontaneous cure has to be reckoned with in these carrier rabbits, and that therefore, very much larger series of animals than those hitherto employed must be experimented with if a correct estimate of the chemotherapeutic influence of chloroform or other substances in the rabbit carrier is desired. The method, however, is at least promising and, in view of recent successes with chemotherapy, not only in lues, but perhaps also in certain bacterial infections, its further development is abundantly called for. Vaccine treatment of chronic carriers has not yielded convincing evidence of cure, but I am informed by Prof. Walker Hall that, in the case of a urinary carrier who has been under observation for a considerable time, the substitution of a vaccine prepared from the homologous organism grown on the patient's blood has had a very marked effect, the bacilli having disappeared entirely, and remained absent for over eight months.

I now pass on to discuss purely administrative measures for the control of carriers. In the first place, with regard to the search for carriers:

(1) When outbreaks of endemic typhoid arise: I have already alluded to the fruitful results obtained by intensive studies of endemic typhoid fever and the explanation afforded by the discovery of associated carrier or carriers. In view of the success thus realized, it is of the highest importance that greater facilities for bacteriological investigation should be at the disposal of public health authorities than at present. Not infrequently bacteriological aid is requisitioned only too late in the course of the epidemiological inquiries into such outbreaks. If necessary, some provision might be made for the dispatch of a floating laboratory to the scene of the epidemic. In typhoid-ridden areas great good may be done, from a prophylactic point of view, in nonendemic periods by bacteriological researches into the presence of carriers in the population and the giving of suitable instructions to such.

(2) Control of declared carriers who have been found associated with typhoid outbreaks: The opinion may now be considered unanimous that carriers who are employed in dairy work and in the sale or preparation of foodstuffs are a particular menace to the public health.

Failing legislative measures to cope directly with this question, it has been the usual practice in such cases to remove the carrier or carriers from such work by some mutual arrangement between the authorities of the dairy and the public health authorities. For example, under the terms of the English Infectious-disease (prevention) Act of 1890, section 4, powers are given to stop the milk supply of a dairy if there is evidence that the milk is spreading infection. The order to do so is removed if the local authority or medical officer of health is satisfied that the cause of the infection is removed. This would provide for the stoppage of a milk supply if a person connected with a dairy developed enteric fever and infection entered the milk therefrom.

The permanent removal of such persons from dairy work could doubtless be legitimately carried out under this provision, but it would involve a more liberal interpretation of the term "healthy carrier." The extension to comprise that of chronic typhoid infection would probably be sufficient, and there is good evidence for regarding the chronic typhoid state as such.

In the interests of the community the removal of such declared carriers connected with dairies is certainly called for. In the case of chronic carriers, such as cooks, waiters in hotels, vegetable sellers, and so on, who have been found to be infective or who have not been found to be infective, it is probable that authorities will have to be content simply with the enforcement of hygienic precautions. Such carriers should be notified, however, and kept under the supervision of the local authorities, and periodically visited, in order to discover if the precautions recommended are being conscientiously carried out.

I come now to the question of the bacteriological examination of convalescents. There is every reason to suppose that, if carriers are discovered at an early period in convalescence, and hygienic recommendations made, the community may to a certain extent be insured against possible spread of infection by such. Also, possibly, curative measures, particularly in the case of urinary carriers, might be instituted with a fair prospect of effecting a permanent cure.

Now, it is clear that such a scheme demands a very extensive machinery for its proper conduct, and a stereotyped routine is liable to suffer, owing to intermittency in excretion, imperfect bacteriological methods, and the willingness or otherwise of convalescents to supply samples of excreta for examination. Further, there is a prospect of revealing only about 3 to 5 per cent of chronic carriers. Hence the prospective crop of carriers is small in comparison with the enormous amount of work involved. Dr. Theodore Thomson and myself tested the practicability of this method during two years, 1909–1911. I am unable to give the full facts here. It will suffice to note that convalescents leaving the Metropolitan Asylum's Board hospitals, while still carrying the bacilli in their excreta, were examined once a month for six months, and then, if negative, at the end of a year. The chief difficulty encountered was the punctual dispatch of excreta for examination, the responsibility for which was largely that of the medical officer of health of the district. After a time all convalescents who left the hospital, whether infective or not infective, were examined. The result, so far as I am at present enabled to state, was that only about 2.5 per cent of these convalescents remained carriers at the end of a year. All were females. Over 2,000 separate samples of excreta were examined during that time. There is no doubt that, with active cooperation between the health authorities, the people at large, and the bacteriologist such a plan is feasible and worth the trouble involved. Probably the examination of the excreta of the convalescent once a month for three months would be amply sufficient.

Permanent isolation is perhaps the most effective measure of all, but can be applied satisfactorily only in the case of asylums and similar institutions. In small asylums the expense that this procedure involves may be a serious hardship. These lunatic carriers in asylums undoubtedly constitute the best material for the investigation of the carrier status, for the simple reason that it is always available. Prolonged trials of various therapeutic measures can be readily carried out, and intensive bacteriological studies can be undertaken, provided the necessary facilities for such work are to hand. The latter condition is, however, rarely satisfied, and it would seem to me a question worthy of consideration whether all such carriers could not be drafted to some central institute, probably in connection with a large fever hospital, where a competent bacteriologist, acting under an advisory committee, might undertake a special study of the many problems connected with the carrier state. In such an institute provision might also be made for the reception of sane carriers (probably of other diseases, e. g., diphtheria carriers) who may offer themselves for study.

There is finally the question of modification of the treatment of enteric fever, with a view to the prevention of the onset of the chronic carrier state in convalescence.

This is a problem which can at present be only tentatively considered, but it is to be hoped that a solution will come with the development of a rational therapy in enteric fever directed toward the extermination of the bacilli before they have acquired a permanent focus of vegetation in the body.

There are certain points connected with the subject of paratyphoid carriers to which attention may be directed.

The discussion of paratyphoid fever and the etiological rôle of carriers in connection therewith is at the present time an undoubtedly difficult task, by reason of lack of settled opinion, partly among bacteriologists, and partly among clinicians.

On the bacteriological side all observers are agreed that three of the four members of the Gaertner-paratyphoid group, viz, *B. suipestifer, B. entertidis Gaertner,* and *B. paratyphosus B.* are culturally and biochemically indistinguishable.

By agglutination methods, *B. enteritidis Gaertner* and *B. paratyphosus A.* can be easily separated off, while the difficulty has centered round the differentiation of *B. suipestifer* and *B. paratyphosus B.* Now, many German writers, who have not employed absorption methods, maintain the view that *B. suipestifer* and *B. paratyphosus B.* are indistinguishable, whereas the recent work of Boycott, Bainbridge, and Bainbridge and O'Brien, has, in my opinion, very clearly shown the possibility of differentiating these organisms by absorption methods.

I have had an opportunity of observing for myself the striking differences between *B. paratyphosus B.* and *B. suipestifer,* which can be elicited by carefully performed absorption tests, and I would here allude to the striking light thrown by these experiments on the epidemiology of this group of organisms. These authors (Bainbridge and O'Brien) procured from various sources, mostly German, a number of so-called paratyphoid bacilli. These on examination by cultural methods, and by agglutination and absorption tests, fell into two groups, viz, one group identical with standard strains of *B. suipestifer*, and the other with standard strains of *B. paratyphosus B.* Moreover, all their strains which proved to be genuine *B. paratyphosus B.* had been isolated from cases of paratyphoid fever, or from paratyphoid carriers, whereas those which proved to be identical with *B. suipestifer* had been derived from foodstuffs or cases of food poisoning. Much of the evidence on which the so-called ubiquity theory has been based by certain writers, including Prof. Conradi, is, in my view, largely discountenanced, not only by this work to which I have referred, but also by neglect in many cases to apply differential tests, which must be considered at the present time to be absolutely essential before an organism can be admitted to this group at all. I would also refer to the support which these results of Bainbridge and O'Brien have received from the work of H. R. Dean, who effected a separation by complement fixation, and also to the strikingly interesting work of Reiner Müller and of Penfold. The latter, using the raffinose-papilla test of Reiner Müller, examined the same collection of strains which Bainbridge and O'Brien employed, and, the results by the two methods agreed absolutely.

The source of genuine paratyphoid infection is mainly the paratyphoid patient, and the paratyphoid carrier, and the infectivity of the latter has been abundantly attested by certain recently recorded outbreaks.

In the case of *Paratyphoid A.* infection, to which much attention has been directed in India, it would appear that the transitory carriers who have had mild or abortive infections are the most fruitful sources of infection.

Chronic carriers of Gaertner bacilli are also known (gall-bladder cases) and I have recently obtained cognizance of at least two chronic urinary Gaertner carriers, but I am not aware of these having at any time proved their infectivity.

In the case of diphtheria carriers, attention should be directed (1) toward preventing the distribution of bacilli by the carrier and (2) toward preventing the direct or indirect association of the carrier with susceptible individuals.

I do not propose to discuss the methods which have been recommended and practiced for the cure of diphtheria carriers. No effective remedy has yet been evolved, but the results of certain measures, such as the inoculation of bacterial vaccines, first advocated by Petruschky, and the spraying of the throat with live cultures of the Staphylococcus, as recommended by Schiötz, undoubtedly afford evidence suggesting further extensive trials. One might also refer to the promising results of Hewlett and Nankivell with vaccines prepared from the ground-up diphtheria bacilli (modified Macfadyen-Rowland process). When the fauces only are infected, extirpation of the tonsils is likely to prove of service, and should be undertaken after preliminary inoculation of antitoxin. Where there is nasal discharge, the removal of adenoids may be effective.

At present our object should be to restrict as far as possible the potential infectivity of the carrier by the use of antiseptic gargles and other measures, such as those mentioned above.

With regard to measures directed toward the discovery and notification of carriers and their subsequent supervision:

All contacts with diphtheria cases should be swabbed in nose and throat and search should be made for other sources of contamination, e. g., nasal discharges, skin eruptions, whitlows, and so forth, all of which must be treated. Negative evidence as to the presence of *B. diphtheriæ* should not be accepted as final until those intimately in contact have been swabbed at least twice at intervals of four days. Nasal discharges, unhealthy tonsils, and such like demand stricter supervision.

With regard to convalescents and convalescent carriers a negative result should be obtained on at least three occasions, with a week's interval, before isolation is relaxed. All of those examined should, if possible, be accompanied by a separate examination of the nose.

The difficulty arises in the case of carriers who have for long periods yielded cultures regarded as positive. In such cases it is advisable to prepare a pure culture, in order to make certain that the bacillus is properly classed as *B. diphtheriæ* and not one of the rarer forms of diphtheroids which closely resemble *B. diphtheriæ* morphologically. If the bacillus after isolation proves culturally and biochemically indistinguishable from *B. diphtheriæ*, but completely nonvirulent, the question of the isolation of the carrier arises. If there is good reason for supposing that only nonvirulent *B. diphtheriæ* are present, i. e., if the culture appears to contain only one form of *B. diphtheriæ*, then it may sometimes be necessary to relax the isolation in certain cases, but under no circumstances should such a child or person be allowed to return to school or to undertake the care of small children. This measure is specially important if an unhealthy discharge from the nose is present.

There are no definite means as yet of distinguishing between an efficient and a harmless carrier, and such a distinction is probably not permanent. Still, by observing such habits as coughing, sneezing or spitting, and examining for the presence of *B. diphtheriæ* in the saliva, a more accurate estimate of the harm done by individuals may be gained. Arkwright examined the saliva of 24 diphtheria convalescents who were still infected with the diphtheria bacillus at periods of 1 to 3 months after onset. The saliva was collected in sterile test tubes. From 10 of these cases bacilli giving the cultural and biochemical reactions of *B. diphtheriæ* were isolated. Seven of these 10 were virulent and 2 nonvirulent, while the remaining strain was probably identical with the nonvirulent strain isolated from the throat at the same time. By testing the saliva, therefore, one may obtain a measure of the harmfulness or harmlessness of a carrier.

In spite of the facts pointing to the average frequency of nonvirulent *B. diphtheriæ* not being much greater in contacts than in noncontacts, when large numbers of observations are considered, and in spite of the lack of proof of diminishing virulence in convalescents, there is nevertheless some striking evidence of the excessive frequency of nonvirulent *B. diphtheriæ* in contacts and convalescents in some outbreaks, and even of the occasional association of nonvirulent *B. diphtheriæ* with clinical diphtheria. It is probable that the casual connection between carriers of nonvirulent *B. diphtheriæ* and clinical diphtheria can not be neglected, although the nonvirulent strains are possibly of less importance.

As Arkwright has shown, there are great variations in degree of virulence among strains which are undoubtedly virulent, and the nonvirulent types may represent the end stage of a variation proceeding under certain as yet unknown influences in the throat. An attempt has been made by Kolmer to show that by the morphological appearances of the organisms isolated an opinion can be formed as to their possible virulence or lack of virulence.

Such a procedure would be undoubtedly of value if it could be relied upon, but from Kolmer's work it is not clear whether the glucose test was applied, and consequently whether some of the solid, presumably avirulent, forms were really Hoffman strains, regarding which most authorities are of opinion that they are not related to Klebs-Loeffler bacilli in any way.

With regard to bacillary dysentery, this, so far as Great Britain is concerned, is usually confined to asylums, and only very rarely in the last three years have a few isolated genuine outbreaks occurred. These and the asylum cases have been usually due to infection by members of the large mannite-fermenting group, of which no single organism can be regarded as the type.

With regard to the spread of the disease during an epidemic, or its importation during the epidemic season from one town or district to another, probably the mild catarrhal cases, the convalescent carriers, and the cases relapsing at short intervals (especially in asylums) are the most active, but as regards the survival of the *B. dysenteriæ* from one epidemic to another the relapsing and chronic cases of dysentery must be looked on as the sources of danger. If, however, observations like those of Simon are confirmed, the chronic convalescent carrier assumes a still more important position. This author has shown that the bacilli may persist after convalescence (intermittently) for 137 to 404 days, with an average of 214 days.

It is important, therefore, that a close watch should be kept over persons who have once been infected, and any attack of diarrhœa occurring in a formerly infected person must be considered suspicious and as requiring reexamination. On the occurrence of a fresh outbreak of dysentery, those who have formerly been infected must be reexamined.

THE PROBLEM OF THE DETECTION OF THE TYPHOID CARRIER, FROM THE STANDPOINT OF A LARGE MUNICIPAL HOSPITAL.

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The recognition of the existence of disease carriers among insects—the mosquitoes, lice, and bedbugs—various domestic and wild mammals, and man himself, has made modern preventive medicine the effective force it now is in the conquest of infectious diseases. No other agency has wielded so tremendous a vitalizing or civilizing effect upon vast numbers of people. One has but to recall the success obtained in combating yellow fever in Cuba, malaria in Italy and Greece, Malta fever, and the successful campaign against the tropical diseases in Panama carried on by Col. Gorgas.

The detection of disease carriers, namely, those persons, be they healthy or ill, who harbor and eliminate disease-inciting microorganisms which may infect other people, is the paramount hygienic issue of modern times. The epidemiological importance of human disease carriers may be taken for granted; supported, as the evidence is, by a vast array of observations and facts. It may be asserted that all persons who have reached adult age have been or actually are distributors of one or more of the microorganisms which are the inciting agents of such diseases as malaria, tuberculosis, syphilis, gonorrhea, typhoid, diphtheria, the exanthenata, epidemic meningitis, infantile paralysis, and the diseases induced by the various pathogenic bacteria.

It will require the united efforts of the public health services—and, most important of all, the general medical profession—to properly control the disease carrier in the future. The irregular or unlicensed practitioners, the faddists, and Christian Scientists, who, from professional or pseudo-religious principles, do not recognize the existence of disease, must be coerced to report to the health authorities all cases of infectious diseases coming under their care, under penalty of revocation of their licenses, or with heavy fines and imprisonment. Ample authority for such measures is founded upon the Latin proverb: Salus populi, suprema lex est. Koch obtained his authority to wage the successful campaign against typhoid fever, begun a decade ago in Germany, by appeal to the Prussian laws of 1835, prescribing the measures to be pursued during pestilences. The illuminating researches upon typhoid fever in the German Empire which were inaugurated by Dr. Koch and his coworkers will in time be recognized as one of the most noteworthy contributions to modern preventive medicine. We have learned that typhoid infection is largely one of contact, from the ill to the well, or indirect contact, through the agency of food and drink, especially milk, contaminated by disease carriers. In fact, Frosch has stated that the eradication of typhoid fever is a problem dependent entirely upon the efficient control or elimination of the typhoid bacillus carrier.

Although the epidemiological importance of typhoid fecal carriers may be said to date from the researches of the German typhoid stations, many facts had already been collected pointing to the danger of such persons. Horton-Smith, in the Gouldstonian lectures of 1900, drew attention to the danger of urinary carriers, having obtained a percentage of 25 in his typhoid cases. In fact, Horton-Smith pointed out the possibility of danger from the feces of convalescents. Actual proof, however, of the elimination of typhoid bacilli was not furnished. Attention was first drawn by Louis to the frequent occurrence of cholecystitis following attacks of typhoid fever, and, in 1889, Bernheim noted the frequency of attacks of gallstone following typhoid fever. In 1888 Futterer found *B. typhosus* in the gall bladder. Later, Gilbert and Girode, Chiari, van Dungern, and Cushing, and Miller, in this country, greatly increased our knowledge of the cholecystitis of typhoid fever. Blackstein and Welch were the first to note the constant occurrence of typhoid bacilli in the gall bladder of animals after intervenous inoculation with typhoid cultures, the organism having been found as late as 128 days after inoculation, when the bacteria had disappeared from the other organs. Flexner, in 1891, found typhoid bacilli in the gall bladder in 50 per cent of the cases dead from typhoid fever. Foster and other observers have shown that in practically all cases of typhoid fever the organism is found in the bile after death. The discovery of fecal carriers seems to have been delayed solely by the difficulty in isolating the bacillus from the feces.

It is my intention to discuss the small but important share that the hospital should play in safeguarding the public health. The large number of people which pass through a municipal hospital, having some form of infectious disease, clearly shows the responsibility of the hospital in reporting such cases to the health authorities.

The value of this work depends upon the diagnostic skill and scientific resources of the clinicians and the laboratory staff.

At the request of Dr. John Winters Brannan, president of the board of trustees of Bellevue and Allied Hospitals, the pathological department of Bellevue Hospital has investigated, for the past year, as far as circumstances would permit, the question of the convalescent typhoid carrier. Whenever possible, the department has held carriers until their excreta were bacilli free. All patients who, at their discharge, were still eliminating bacilli, were furnished with information blanks outlining briefly the elementary rules of hygiene and cleanliness. The possibility of their contaminating the food and drink of others through their uncleanly habits was pointed out to them. The board of health was furnished with the name and address of all convalescent carriers at the time of their discharge. These measures were taken in the hope of diminishing the number of contact infections and of educating the public in regard to simple sanitary matters.

The crusade against public spitting inaugurated by the New York Board of Health, under the guidance of Dr. Hermann M. Biggs, which has been so successful, although it has taken many years to train the public, enticed the department to play the rôle of an educator of hygiene to the public. It was considered inadvisable to make these instructions as full as those issued by Davies and Walker-Hall, of Bristol (1908), or those issued at Strassburg (1910).

Our examination of the convalescent carrier was begun a year ago this September, when the new building of the pathological department was opened. The material was drawn from Bellevue Hospital, having 1,000 beds, and from the allied hospitals, containing altogether about 350 additional beds, and distant an hour's traveling from the Bellevue laboratory. The routine examinations were made by Dr. Guy Wallace, Miss Ethel E. Lawrence, and by Drs. B. Morgan Vance and Emil Boehm. To these I wish to express my thanks for their devotion and painstaking work.

A low percentage of positive results was obtained during the active stage of the disease, due in part to the fact that the average of specimens examined per case was 1.59. One hundred and thirty-two convalescent cases were examined shortly after defervescence, 6 positive urine and 11 positive fecal cultures were obtained, making a percentage of 13.87 per cent as the total, and a percentage of 8⅓ for the fecal carriers. The positive feces findings occurred between the first and the twenty-ninth day after defervescence. In only two cases was the organism found on two successive examinations. Many patients had received urotropin during the course of the disease, so that the urinary findings will not be considered.

Endomedium prepared without modification poured into large Petrie dishes was used for the fecal examinations. All suspicious colonies were stabbed into Hiss's dextrose gelatine agar tube medium. All nongas-producing dextrose strains were transplanted into broth for agglutination tests, with a 20,000 antityphoid rabbit serum, and all strains were tested for their cultural characteristics upon litmus milk, sugar-free Hiss serum water, and North's agar medium, to which had been added the usual sugars and other sugars less commonly employed, namely, galactose, maltose, dextrin, and so forth. All the typhoid strains identified as *B. typhosus* agglutinated to the limit. Occasionally, bacillary strains were found agglutinating at 10,000, but none of these strains was found to possess the cultural peculiarities of *B. typhosus.*

Our findings agree with those obtained by Kayser, who found that 93 per cent of the convalescents are bacillus free two weeks after defervescence. Semple and Grieg, in India, found a carrier percentage of 11.6 among convalescents who eliminated bacilli for a period longer than six weeks. According to Ledingham, the elaborate routine and thoroughness of the work, daily examinations being made, account for the high percentage obtained. Klinger also found 11.6 per cent temporary intestinal carriers and 1.7 per cent temporary urinary carriers among 604 convalescents. 1.7 per cent of fecal became chronic carriers, and all the urinary carriers were cured by urotropin. Graham and his coworkers in the Boston City Hospital found a temporary carrier percentage of 23.

A further enumeration of the statistics bearing upon the temporary and chronic carriers collected and reported by German and English investigators may be omitted, since these statistics form the basis for a series of illuminating articles which are well known. The impossibility of detaining convalescents in the hospital until one can be sure that on their discharge they will not at a subsequent period prove to be typhoid carriers, needs no discussion; for we know how intermittent is the discharge of the bacilli in the feces in the temporary as well as in the chronic carrier. The importance of late control examinations is emphasized by Ledingham, and by Klinger, who found a fecal carrier percentage of 3 in a group of 101 people who had suffered from typhoid fever a year before. Great skepticism should be maintained in regard to the cure of chronic carriers, in view of the many cases showing spontaneous cessation of elimination. We believe that the majority of patients who have negative fecal findings in early convalescence will not later on become chronic carriers. We admit there is no scientific proof for this statement.

The duty of the hospital ends, it seems to me, when the cases, who, on their discharge, are active typhoid carriers, are reported to the board of health. The question of the continuance of routine examination of the typhoid convalescents in hospitals is open to discussion. I believe that they should be made in all hospitals having suitable laboratory facilities, in order to notify the health authorities of the existence of potential chronic carriers, and for the educational value of these and similar examinations to the hospital staff.

In asylums and other institutions where the patients stay for years, routine examination of stools and urines should be made occasionally in order to prevent institutional contact epidemics, of which so many have been recorded in the literature. All chronic carriers found should be segregated, and have a separate kitchen and personnel. The active and convalescent typhoid and paratyphoid patients should be cared for in wards provided with a nursing force, diet kitchen, and a personnel entirely separate from the other wards of the hospital, as recommended by Kraus and Kirschner, and by Edsall.

The high infectivity of typhoid patients during the first week of disease, as pointed out by Conradi and others, indicates the great importance of efficient sterilization of the excreta. The danger of the stools and urine is sufficiently recognized, but little care is usually taken of the sputum and vomitus, although Drigalski, in 1904, pointed out that enormous numbers of typhoid bacilli may be found in the stomach. Drigalski, Glaser, and Richardson have noted the frequent presence of typhoid bacilli in the sputum of typhoid pneumonia. Again, Mya, Blum, Manicatide, and Gaethens have isolated bacilli from pharyngeal ulcers and from the tonsils of active typhoid cases. It is known that the duodenum is the estuary for the bacilli which are eliminated through the bile ducts and gall bladder. Hess has shown the practical application of the method of cultivating the stomach contents by means of stomach tubes in the case of infants suffering from typhoid fever—a method originated by Weber, who used the Vohlhardt oil breakfast in order to excite a regurgitation of the duodenal contents into the stomach. In the case of adults, Hess recommends a duodenal tube as devised by Gross or by Einhorn.

The early detection of typhoid and paratyphoid infections, and the recognition of atypical cases, is of great importance. A. Baginsky has pointed out that many apparently harmless cases of febrile dyspepsia in children may be typhoid. Velich has collected 36 cases of adults which ran a severe course with a clinical picture of heart failure. In addition, Curschmann has emphasized the fact that typhoid fever may run its course under the guise of a malaria, of influenza, or of cerebral or cardiac intoxication with hemorrhage and perforation. Koch, in his famous address, dwelt upon the importance of recognizing the mild or walking cases of typhoid. The experience of the Bellevue morgue has been similar to that of all pathological institutes. I may add that most of the short cases of typhoid which have come to autopsy in my experience have been subjects of status lymphaticus, and have had a clinical course marked by severe cerebral symptoms of intoxication.

All cases of cholelithiasis in the hospital should be examined to determine the possibility of their being typhoid carriers. Klinger has reported that, out of 220 chronic carriers, definite symptoms of gallstones were elicited in 13.6 per cent of them. It is said that only 10 per cent of the cases of cholelithiasis have clinical symptoms. On the other hand, it is known that cholelithiasis may run its course with slight digestive disturbances, and, again, a number of cases have been reported in which attacks of gall colic precede typhoid fever. Such people may be carriers who have never developed typhoid within their knowledge, either on account of a more perfect local intestinal or general systemic immunity to typhoid infection. The duodenal test is indicated in every case of colic, or of gastric or intestinal disturbance, and the bile or gallstones obtained at operation should be cultivated. We are cultivating the bile and spleen of every case that comes to autopsy, the gall bladders, ducts, and parts of the liver being saved for a subsequent histological examination to confirm the experimental work of J. Koch and Chirolanza on the pathology of the typhoid carriers. The bacteriological examination of all urines may in time furnish valuable statistics as to the frequency of infections with the colon typhoid group in such obscure diseases as the hematogenous infections of the kidney, pelvis, and urinary bladder.

The nurses and doctors who have charge of typhoid patients should be vaccinated. The efficiency of this simple prophylactic measure is amply testified to by its success in diminishing typhoid in the Army. In India, where the paratyphoid infections of the A type are so frequent, it has been suggested that appropriate vaccine treatment should be instituted. In Germany, there is a tendency to disregard paratyphoid infections, on account of their mildness, in the general campaign waged against typhoid fever. Conradi and Klinger have pointed out the danger and number of such transitory carriers whose work brings them into contact with typhoid patients. Semple and Grieg have shown that nursing orderlies were particularly liable to act as transitory carriers, and, in the French garrison at St. Brieuc, 11.4 per cent of the infirmiers, who showed only ephemeral symptoms of disease, were found to be eliminating typhoid bacilli during an epidemic. I therefore urge the examination of the personnel attached to the typhoid wards to determine the presence of temporary or precocious carriers. An efficient control of the personal disinfection and cleanliness of the nurses attached to the typhoid wards may thus be furnished.

I may now briefly refer to the so-called paratyphoid infections and to the diseases following the ingestion of infected meat. Much confusion in regard to the etiology of these diseases has been caused by the difficulty experienced in identifying the members of this numerous group of bacilli. It may be frankly stated that up to date the final word concerning the epidemiology and bacteriological identity of these diseases has not been said. In the splendid Milroy lectures of this year by Prof. Bainbridge, he states that paratyphoid and meat poisoning infections are caused by different bacilli which, though so closely allied, may be differentiated by elaborate cultural tests, supplemented by agglutination reactions when combined with absorption and complement deviation tests. He claims that the distribution of the organisms causing these conditions are unlike; thus, the paratyphoid fever of both A and B types is spread like typhoid fever by human bacillary carriers, "whereas meat poisoning is caused by consumption of food which is derived from infected animals or is contaminated by animal agency."

It is admitted that there have been occasional cases of acute gastroenteritis due to infection with *B. paratyphosus A* and *B*, and that on the other hand, the illness following consumption of meat infected with the true Gaertner's bacillus, or *B. suipestifer*, may take the form of a fever lasting several weeks. The point is well taken that the occurrence of a few cases having a somewhat similar clinical picture is not an argument in favor of the identity of these organisms, as Huebener and others maintain. We need only recall the protean course of typhoid fever and the numerous chronic carriers who have had no previous history of illness.

German writers at the present time have employed the term paratyphoid to apply to all forms of disease associated with the presence of any member of the salmonella or intermediate group of Durham. This definition of paratyphoid fever is based on bacteriological grounds, the German writers believing that the *B. paratyphosus B* and *B. suipestifer* are identical. The thorough work of Bainbridge and O'Brien, Savage, Boycott, Dean, and others, have shown that, by the employment of absorption and complement deviation tests, *B. paratyphosus B* may be differentiated from *B. suipestifer*. It is claimed by Bainbridge that the Germans have made no systematic use of those methods which are essential for proper identification. The distinction between these organisms not being admitted, they have failed to recognize their very different distribution and nature. Bainbridge claims that paratyphoid fever and the gastroenteritis produced by meat poisoning are different diseases, more especially as regards epidemiology, and that recognition of this fact is a necessary preliminary to any advance in their treatment by preventive measures. Paratyphoid fever resembles typhoid fever clinically, has a latent period of from 8 to 18 days, and is caused by *B. paratyphosus A* and *B*, the usual mode of infection being human carriers; whereas the characteristic symptoms of meat poisoning are those of an acute gastroenteritis of comparatively brief duration, with short latent period of 48 hours caused by *B. enteritidis Gaertner* or *B. suipestifer*, the usual source of infection being meat. There is no evidence of infection of meat through the agency of human carriers in either the case of *B. enteritidis* or of *B. suipestifer*. The *B. paratyphosus C* has been shown by Morgan to be a nonlactose splitter, occasionally present in human stools. This fact may account for some of the so-called cases of paratyphoid which have been reported, but not properly identified in a bacteriological sense.

Savage classifies the organism of the group under discussion into two subgroups: The true Gaertner bacilli and the Para-Gaertner bacilli; they are differentiated by the use of salacin, raffinose, and glycerin, the Para-Gaertner bacilli alone fermenting these substances. The Para-Gaertners have been found by him 11 times in the intestinal contents of 31 animals, the organisms are not appreciably agglutinated by sera obtained by immunizing animals with any of the members of the true Gaertner subgroup, and they are for the most part nonpathogenic. Savage emphasizes the necessity of differentiating the organisms in these groups in order to avoid erroneous conclusions as to their distribution in nature.

A critical review of the literature of the colon-typhoid-dysentery group justifies the opinion that too hasty conclusions have been drawn upon the etiological significance of many of the members of this group. We recall that *B. suipestifer* is now known to be merely a secondary invader, and we draw attention to the delay in recognizing the mannite and nonmannite fermenters of the dysentery group—a delay the more extraordinary, in view of the marked differences in their agglutination and animal reactions. When bacterial examinations are made in large numbers and, necessarily, in haste, the identity of the organism obtained is often questionable. A word of warning has been uttered recently by Veeder and his coworkers; they found that in only 20 per cent of the cases of ileo-colitis occurring in infancy were dysentery organisms present. While in some of these cases the infection with dysentery organisms was primary, in others it was probably secondary, and he wisely, I think, concludes that the presence of a few dysentery organisms in a case of acute intestinal disturbance in an infant does not in itself prove that the organisms have any etiological relation to the condition.

On account of the difficulty and uncertainty in the bacteriological determination of the meningococcus without agglutination tests, which are so often unsatisfactory, it seems to me that the detention is unnecessary and unscientific in the case of immigrants arriving in ships carrying cases of epidemic cerebro-spinal meningitis. For we must recollect that severe epidemics of this disease occur every seven or eight years, and that sporadic cases are present every year in this country. Furthermore, it is known that there are more disease carriers than cases of illness.

In cholera the same latent appearance of infectious spirilli is observed. They usually disappear during the first or second week of convalescence. Kohler, Buergers, and Gotschlich have found them several months after convalescence. In the Mecca pilgrims who have shown no symptoms of cholera the spirilli have been found quite frequently. These pilgrims are examples of the true Zwischentraeger of Friedberg. Cholera spirilli have been found by Kulescha in the gall bladder of a few cases dying a year after survival of an attack of cholera.

The typhoid fever of cities furnished with a pure water supply originates from two sources, namely, contact with active cases of typhoid or of precocious or chronic carriers, and from an infected milk supply. In large cities the eradication of contact infections, in tenement houses, or from food and drink obtained in the poorer class of restaurants and boarding houses, seems hopeless. Our principal effort must be devoted to rendering pure the milk supply of the city. There is evidence for the belief that typhoid fever is largely a disease of the country, although it is quite true that only a certain proportion of the epidemics have been traced to milk.

The state must take more effective measures for the protection of its milk supply. These measures include the thorough inspection of the water supply of the farms which sell milk, the regulation of the milking, and the efficient scouring of the cans and bottles. Special attention should be paid to the sanitary conditions of the barns and especially of the privies in the neighborhood of the farms. The milkers, farm hands, and all persons employed in handling the milk or the cans should be examined to determine the presence of carriers among them. In fact, all people who have had typhoid fever at any time must be considered a source of danger when employed in a pursuit which involves the handling of food or drink. These may be the deal requirements; they can not be carried out until appropriate and uniform legislation has been passed in the various States of the Union. The difficulty in regulating the milk supply of a large city is apparent when one considers that New York obtains its milk from eight or nine hundred farms situated in five States having different or indifferent laws. In Philadelphia, according to Hand, only 2 per cent of the milk sold is certified. This result has been obtained after 12 years of hard work upon the part of the milk commission of the Philadelphia Pediatric Society.

According to Coit, "the standards of safety consist in the use of every known means to exclude from the milk pathogenic microorganisms, a medical guaranty that every employee handling the milk is free from disease and is not a disease carrier, and a veterinary guaranty that the cattle are in perfect health, and can not transmit through the milk any bovine affection." The necessity of bacteriological stations, similar to those that have been established and run so successfully in Germany for 10 years, can not be questioned. Until such stations are in running order, all milk, cream, and butter sold in cities should be efficiently pasteurized (as has been urged by Behla and many others). On account of the method of manufacture, cheese seems to be less dangerous.

The standing orders in relation to the persons employed in handling food in the military medical service of India, and the recommendations which have lately been made in Germany concerning the regimental kitchens, clearly indicate the ways and means of dealing effectively with the carriers in the civil population. At the present time much good is being done in Germany by retaining all carriers as long as possible under bacteriological supervision, and by giving suitable instructions with regard to the disinfection of their excreta and of their hands, and by oral and written advice as to the occupations they should avoid. To reduce the contact infections of the guests of hotels and restaurants, I would urge that examinations be made of the kitchen help and the waiters for the determination of the presence of carriers among them. Owing to the greater proportion of carriers among women, special attention should be given to the female cooks. No cook having a history of gall-stone colic or indefinite stomach or intestinal trouble should be permitted to endanger the lives of the people she serves. Through the education of the public, it may be possible to create a sentiment which would force hotels and restaurants to see that these regulations are carried out. The examination of cooks employed in private families or small boarding houses would present great difficulties. In time housekeepers may be educated to see the necessity of insisting upon the ordinary rules of cleanliness in their kitchen help, and, again, popular education may suffice to bring about a sentiment in favor of employing help who may be able to present a State health certificate.

"The establishment of provincial typhoid stations seems unavoidable, if we are to be earnest in our endeavors to eradicate typhoid fever. The duties of the physicians at the stations will be to assist local physicians in the diagnosis of typhoid fever, to ascertain the source of infection in typhoid cases, and to seek out carriers; to watch for unhygienic conditions, and to make recommendations concerning them," to quote from Ledingham.

The familiar quotation of Pope, "The proper study of mankind is man," applies admirably to modern preventive medicine.

DIPHTHERIA BACILLUS CARRIERS.

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[From the Research Laboratory, Phipps Dispensary, Johns Hopkins Hospital.]

I. OBJECT.

1. To determine the incidence of *B. diphtheriæ* in the throats of individuals in the city of Baltimore not suffering from clinical diphtheria.
2. To determine the persistence of *B. diphtheriæ* in the throats of persons yielding positive cultures.
3. To determine the virulence of *B. diphtheriæ* present in positive cultures.
4. To determine the previous and subsequent history and the relation to the community, with reference to clinical diphtheria, of persons having positive cultures.

II. PROCEDURE.

1. *To determine the incidence of B. diphtheriæ in the throats of individuals in the city of Baltimore not suffering from clinical diphtheria.*

In undertaking the investigation herein reported, school children were selected as being the most suitable as well as the most available group of individuals upon which to carry out such an investigation.

Ten schools were chosen from as many different sections of the city, and 100 children were selected from each of these schools in such a way as to get approximately equal numbers of males and females, different school ages, and so forth.

The cultures were taken from the throat only, and were made at the rate of 100 a day, on successive days, as far as possible, until the thousand cultures had been taken.

The accompanying table gives the results of the original 1,000 cultures:

Date of culture.	School.	Number of children cultured.	Age, in years.	Sex.		Color.	Number positive.
				Male.	Female.		
Mar. 14, 1911	I	100	6–8	93	7	White	2
Mar. 15, 1911	II	100	8–10	48	52	...do...	6
Mar. 16, 1911	III	100	10–12	53	47	...do...	1
Mar. 17, 1911	IV	100	11–16	46	54	...do...	0
Mar. 20, 1911	V	100	11–16	48	52	...do...	7
Mar. 21, 1911	VI	100	6–8	50	50	...do...	2
Mar. 22, 1911	VII	100	8–10	44	56	...do...	6
Mar. 23, 1911	VIII	100	10–12	55	45	...do...	5
Mar. 24, 1911	IX	100	11–16	51	49	Black	0
Mar. 27, 1911	X	100	11–16	16	84	...do...	4
		1,000	....	504	496	....	33

The above table shows that, of the 1,000 children, there were 33, or 3.3 per cent, whose throat culture yielded a bacillus which, on its morphology and staining reaction, could be classed as *B. diphtheriæ*. The table further shows that, of the children whose culture was taken, approximately half were males and half were females; 800 were white and 200 were black; the ages varied from 6 to 16 years, with approximately the same number in each year of life between these two extremes.

The incidence of positive cultures apparently bears no relation to the age, color, or sex of the children.

In two schools (No. IV, age 11–16 white, and No. IX, age 11–16 black) the 100 cultures taken in each were all negative, while the highest percentage was found in School V, age 11–16 white, which gave 7 positive cultures.

In order to ascertain in how far a single throat culture determined the presence or absence of diphtheria bacilli and to what extent 100 cultures from any given school might be taken as giving the percentage of positive cultures in the whole school, recultures were taken on the original groups of 100 in the schools showing the highest and lowest percentages of positive cultures (IV and V), together with cultures from an additional group of children in each of these schools.

On the reculture in School IV, made May 3, 1911, there were present only 75 of the 100 children originally examined on March 17, so that 25 additional children were selected in order to make up the desired number. No diphtheria bacilli were found in the original 75 or in the additional 25.

On May 4, 1911, cultures were taken from 82 additional children between 9 and 13 years of age in School IV, and four positive cultures were found, approximately 5 per cent.

The reculture in School V was made on May 2, 1911, when it was found that there were present only 90 of the 100 children originally examined on March 20, so that 10 additional children were selected to complete the 100. On this reexamination, 7 positive cultures were found among the original 90 children, and among the 10 additional children there was 1 positive culture. Of these, only 2 were positive on the first examination. One of those positive at the first examination was absent at the time of reexamination. Thus, of 90 children who were examined twice, an interval of about six weeks elapsing between the first and second cultures, 6 were found positive on the first examination, and 7 on the second, making a total of 13, only 2 of which were positive both times, leaving 11 positive at one or the other examination, or 12.2 per cent.

On May 1, 1911, cultures were taken from an additional 100 children, between the ages of 6 and 8 years, in School V, six of which yielded diphtheria bacilli.

The above results are collected in the following table:

	Positive cultures.
1,000 original children	33
25 additional children (School IV)	0
82 additional children (School IV)	4
10 additional children (School V)	1
100 additional children (School V)	6
1,217 (3.61 per cent)	44

Of the above 1,217 children, 165 were recultured, and a total of 51 positive cultures were found, only 2 of which were positive on both examinations, giving 49 children who at some time had a positive culture.

From these results, it is clear that a single culture is not sufficient to determine the presence or absence of diphtheria bacilli, as is already well known, and that a second culture almost doubles the chance of finding them, if they are present. In this case, however, where the second culture was made after a lapse of a considerable interval of time, one must bear in mind the possibility that infection may have taken place between the first and second examinations.

As to the other point raised, namely, the validity of taking the results of cultures on 100 children in a school, as an index of the incidence of bacillus carriers in the school as a whole, we have perhaps insufficient data from which to draw conclusions. In School V, which presumably was heavily infected, the results of the examination of the two groups of 100 each were almost identical, seven positive in the first and six in the second; whereas, in School IV, in which no positive culture was found in the original 100 children on either the first or second examination, four positive cultures were found on examining 82 additional children.

It is certain that a single examination for diphtheria bacilli of every individual in an entire community would yield a number of positive cultures far below the real incidence of bacillus carriers, and repeated cultures over a protracted period would be necessary to determine even approximately the total number. Investigations of this sort have usually been made on school children, hospital patients, or inmates of asylums of various kinds; that is, on some particular and usually isolated group in the community; we have sought, therefore, to determine in how far the results of our examination of school children can be taken as representative of conditions in the community at large, and have as evidence the results of other cultures taken on a fairly large number of individuals of the most diverse ages, occupations, and walks in life.

As a part of another investigation,[1] cultures were taken on the inmates of 39 of the homes of members of the faculty of the Johns Hopkins Medical School, and of 143 houses in which students of the school roomed or boarded. These cultures were taken, as far as possible, on all the inmates of these houses, men, women, and children, including servants.

In the faculty houses, there were 194 cultures taken on March 5 and 6, 1911, of which seven, or 3.6 per cent, were positive. In the student houses, 646 cultures were taken on February 26 and 27, 1911, 25, or 3.87 per cent, of which were positive.

The homes of the faculty members are scattered throughout the best residential portions of the city, while the student boarding houses may be divided roughly into three groups, two of which lie more or less adjacent to the medical school, while the third is scattered over widely divergent sections of the city.

The above results, when tabulated and summarized, present themselves more concisely:

Faculty houses:	
Total number of houses	89
Number of houses where cultures were taken	40
Number of cultures taken	194
Number of positive cultures (3.60 per cent)	7
Student boarding houses:	
Total number of houses where students lived	160
Number of houses where cultures were taken	143
Total number of people in these 143 houses	921
Average number living in each house	6.44
Total number of cultures taken	646
Number of positive cultures (3.87 per cent)	25

Distribution of positive cultures according to location.

	Houses.	Positive cultures.
Group A (city at large)	56	11
Group B (vicinity of medical school)	56	10
Group C (vicinity of medical school)	48	4
Total	160	25

Of the 25 positive cultures, 4 were in students attending the Johns Hopkins Medical School. Of the 21 positive cultures not among medical students, only 3 occurred in houses where there were students who had positive cultures.

On March 9 and 10, 1911, throat cultures were taken on all patients, doctors, students, and attendants entering the Johns Hopkins Hospital Dispensary. Three hundred and fifty cultures were taken, 11 of which were positive for *B. diphtheriæ*, or 3.14 per cent.

On March 7, 1911, throat cultures were taken on 100 teachers and pupils at a private school for boys, near Baltimore, of which 2 were positive.

A summary of the above results, compared with the results taken on 1,000 public-school children, shows as follows:

	Number of cultures taken.	Positive cultures.	Per cent.
In faculty houses	194	7	3.87
In student boarding houses	646	25	3.60
In private school near Baltimore	100	2	2.00
In dispensary patients, attendants, and so on	350	11	3.14
	1,290	45	3.48
On public-school children	1,000	33	3.30

The above figures would seem to indicate that the results of cultures taken on Baltimore school children gave a reliable index to the incidence of *B. diphtheriæ* in the throats of the population of the city at large.

2. *To determine the persistence of B. diphtheriæ in the throats of persons yielding positive cultures.*

Of the 49 children who had positive cultures when examined between March 14 and May 4, 1911, 46 were reexamined between June 14 and June 22, 1911, three of the children having meanwhile moved out of the city. After this lapse of about one and a half to three months, 10 of the 46, or 21.74 per cent, still yielded positive cultures. Had repeated cultures instead of single cultures been made, after this lapse of time, it is probable that a much larger percentage would have been found positive. Furthermore, the reexamination was made during the early summer, a time when the incidence of clinical diphtheria is much less than during the winter months.

3. *To determine the virulence of B. diphtheriæ present in the positive cultures.*

From the 49 originally positive cultures, *B. diphtheriæ* was isolated in pure culture in 26, and the virulence tested. Six cultures (23.07 per cent) proved virulent, and 20 avirulent.

Only 46 of the 49 children who previously showed diphtheria bacilli in their throats were available for examination in June, 10 of whom still gave positive cultures. Klebs-Loeffler bacilli were isolated in pure culture from 9 of these, and all proved avirulent. Of the 9 June cultures the virulence of which was tested, only 2 were among the 26 previously tested, thus making 33 cultures isolated, from as many children, on which we have virulence tests. Six of these were virulent, or 18.18 per cent.

The organisms isolated were repeatedly tested for virulence at intervals of some weeks—eight times, in one instance—and in every case the original result was confirmed.

4. *To determine the previous and subsequent history and the relation to the community with reference to clinical diphtheria of persons having positive cultures.*

The information sought in this part of the investigation is of the greatest importance in the determination of the attitude which sanitary authorities should adopt toward healthy diphtheria bacillus carriers.

The following five questions were asked, during the third week in June, concerning each of the children who had given a positive culture:[2]

1. Had you had diphtheria previous to the time throat culture was taken?
2. Have you had diphtheria since culture was taken?
3. Had you been exposed to a case of diphtheria before culture was taken?
4. Have any of your associates developed diphtheria since culture was taken?
5. Have you had any throat trouble during the past year; and, if so, of what nature?

As many of the children were too young to give reliable answers to the above questions, the information was obtained from their parents and guardians, as well as from the children themselves. It is scarcely necessary to state that the answers to these questions can not be accepted in every instance as accurate, but they were the best that could be obtained under the circumstances, and furnish fairly reliable data on which to base conclusions.

The results are presented in the following table, with certain additional information under the head of remarks:

School.	Culture No.	Virulence of organism isolated.	Diphtheria previous to culture.	Diphtheria subsequent to culture.	Exposure to diphtheria previous to culture.	Diphtheria in associates subsequent to culture.	Any throat trouble in past year.	Throat culture June 14 to 22.	Remarks.
I	532	....	No....	No....	Yes...	No....	Yes...	0	Sore throat at Easter, 1911, treated at home without physician. One sister had diphtheria 10 years ago; one sister had diphtheria 3 years ago. Age of pupil, 8 years.
	550	....	No....	No....	No....	No....	No....	0	
II	620	....	No....	No....	No....	No....	Yes...	0	Sore throat about June 7, 1911. Treated at home without physician. Three members of family had diphtheria 13 years ago. Age of pupil, 8 years.
	635	+	No....	No....	No....	No....	No....	0	
	637	+	No....	No....	No....	No....	Yes...	0	Sore throat about May 17, 1911. Treated at home without physician. Brother had diphtheria 5 years before birth of pupil. No other case in family or neighborhood, so far as known.
	647	+	No....	No....	No....	No....	No....	0	
	665	0	No....	No....	No....	No....	No....	0	
	696	+	No....	No....	No....	No....	No....	0	Playmates (neighbors) had diphtheria 4 years ago.
III	715	0	No....	No....	No....	No....	No....	+	
V	923	....	No....	No....	No....	No....	Yes...	0	Severe sore throat during winter of 1911. Treated by physician.
	932	0	No....	No....	No....	No....	No....	0	
	936	....	No....	No....	No....	No....	No....	0	
	945	....	No....	No....	No....	No....	No....	+	Has oezena; being treated biweekly at Presbyterian Eye, Ear, and Throat Dispensary. Mother had diphtheria about 30 years ago. Age of pupil, 14 years.
	950	0	No....	No....	No....	No....	No....	0	
	960	....	No....	No....	No....	No....	No....	+	
	1000	....	No....	No....	Yes...	No....	No....	....	Exposed to case of diphtheria 5 years ago in orphan asylum where he was an inmate.
VI	1032	0	No....	No....	No....	No....	No....	0	
	1085	....	No....	No....	No....	No....	No....	+	Has colds frequently, which render him hoarse, but does not have sore throat.
VII	1103	0	No....	No....	No....	No....	No....	+	Brothers had diphtheria 14 years ago. Age of pupil, 9 years.
	1119	....	No....	No....	No....	No....	No....	0	
	1157	+	No....	No....	No....	No....	No....	0	
	1166	0	No....	No....	No....	No....	No....	0	
	1171	0	No....	No....	No....	No....	No....	0	Adenoids removed 3 years ago; no throat trouble since.
	1197	+	No....	No....	No....	No....	No....	0	
VIII	1219	0	Yes...	No....	No....	No....	No....	0	Had diphtheria 5 years ago. One brother had diphtheria 11 years ago. Age of pupil, 10 years.
	1244	....	No....	No....	No....	No....	No....	0	
	1250	....	No....	No....	No....	No....	No....	+	
	1268	0	No....	No....	No....	No....	Yes...	0	Sore throat 2 months ago. Treated at home without physician.
	1295	....	No....	No....	No....	No....	No....	+	
X	1422	....	No....	No....	No....	No....	No....	....	
	1455	....	No....	No....	No....	No....	No....	+	
	1475	....	No....	No....	No....	No....	Yes...	0	Sore throat during winter, 1911. Treated by physician.

School.	Culture No.	Virulence of organism isolated.	Diphtheria previous to culture.	Diphtheria subsequent to culture.	Exposure to diphtheria previous to culture.	Diphtheria in associates subsequent to culture.	Any throat trouble in past year.	Throat culture June 14 to 22.	Remarks.
V	1482	....	Yes...	No....	No....	No....	No....	0	Had diphtheria 3 years ago.
	1513	....	No....	No....	No....	No....	No....	0	
	1544	0	No....	No....	No....	No....	No....	0	
	1548	0	No....	No....	No....	No....	No....	0	Brother had diphtheria 7 years ago. Age of pupil, 6 years.
	1563	0	No....	No....	No....	No....	No....	0	
	1564	0	No....	No....	Yes...	No....	No....	0	Brother had diphtheria 6 years ago. Age of pupil, 7 years.
	1586	....	Yes...	No....	No....	No....	No....	0	Had diphtheria 4 years ago. Infant sister ill at present. Throat culture from sister negative for B. diphtheriæ.
	1627	....	No....	No....	No....	No....	No....	0	
	1639	....	No....	No....	No....	No....	No....	....	
	1677	0	No....	No....	No....	No....	No....	0	
	1683	....	No....	No....	No....	No....	Yes...	0	Had sore throat frequently prior to November, 1910, when tonsils were removed.
	1696	....	No....	No....	No....	No....	No....	0	
	1600–6	0	No....	No....	No....	No....	No....	0	
	1807	....	No....	No....	No....	No....	No....	+	Uncle had diphtheria 7 years ago. Did not live in same house and there was no visiting during this illness. Age of pupil, 9 years.
	1815	....	No....	No....	No....	No....	Yes...	+	Severe sore throat at Christmas, 1910. Treated by physician.
	1833	....	No....	No....	No....	No....	No....	0	Tonsillitis frequently prior to 1907, when adenoids and tonsils were removed.
	1848	0	No....	No....	No....	No....	Yes...	0	Has tonsillitis frequently. Last attack about May 25, 1911. Treated at home without physician.

Summary of the answers to the five questions in the above table:

1. Had you had diphtheria previous to the time throat culture was taken? Forty-six negative replies; three affirmative replies. No. 1219, had diphtheria 5 years ago; No. 1482, had diphtheria 3 years ago; No. 1586, had diphtheria 4 years ago.

2. Have you had diphtheria since culture was taken? Forty-nine negative replies.

3. Had you been exposed to a case of diphtheria before culture was taken? Forty-five negative replies; one uncertain (No. 696, playmates (neighbors) had diphtheria 4 years ago; exposure uncertain); three affirmative replies (No. 532, sister had diphtheria 3 years ago; No. 1000, inmate in asylum where pupil lived had diphtheria 5 years ago; No. 1564, brother had diphtheria 7 years ago; pupil then 1 year old).

4. Has any one with whom you have been associated developed diphtheria since culture was taken? Forty-nine negative replies.

5. Have you had any throat trouble during past year, and, if so, of what nature? Forty negative replies; nine affirmative (Nos. 532,

620, 637, 1268, and 1848, sore throat treated at home without physician; Nos. 923, 1475, and 1815, sore throat treated by physician; No. 1683, sore throat tonsillectomy, November, 1910).

III. SUMMARY.

A single throat examination of 1,217 public school children for *B. diphtheriæ* gave 44 positive cultures, or 3.61 per cent and, of 1,290 individuals, in the city at large, gave 45 positive cultures, or 3.48 per cent. Combining these two, single cultures from 2,507 individuals in the city of Baltimore during the spring of 1911 yielded 89 positive cultures, or 3.55 per cent.

Of 46 children who originally had positive cultures, only 10, or 21.71 per cent were found positive after a lapse of from 1½ to three months. We are unable to say whether the bacilli found on the first examination had persisted in the throat of these children, or whether the latter became reinfected during the interval.

In the case of 33 of the children, where *B. diphtheriæ* were isolated in pure culture, only 6 or 18.18 per cent, were found virulent.

Of the 49 children who were found to harbor *B. diphtheriæ,* none developed clinical diphtheria during the period in which they were under observation; only three had previously had diphtheria; and no case of diphtheria could be discovered among the associates of these children.

The results of this investigation do not require much comment. From them, we may conclude that during the spring of 1911 there was a considerable number of diphtheria-bacillus carriers in the city of Baltimore.

A single examination of 1,217 school children revealed 44 positive cultures, or 3.61 per cent. There were at that time approximately 80,000 children in the public schools of Baltimore, and, if the above percentage obtained throughout the schools, we may assume that there were 2,888 diphtheria bacillus carriers in the schools alone.

If we estimate the number for the entire city, using 3.48, the percentage found among 1,290 persons in the city at large, as a basis of calculation, and count the population as 600,000 in round numbers, the result is 20,880 diphtheria-bacillus carriers in the city of Baltimore. That this is far below the actual number is certain, as it represents only the number which we estimate would be revealed by a single examination.

An examination of the records of the Health Department shows 1,035 cases of diphtheria reported for the year 1911, the average number, for the past 13 years, being 1,150 cases. While the number of reported cases does not represent the total incidence, diphtheria is a disease which is reported in a very high percentage of cases.

On the basis of the above figures, there were 20,880 diphtheria-bacillus carriers, and 1,035 cases of diphtheria, or approximately 20 carriers for every case of diphtheria. However, from our virulence tests, we may assume that only 18 per cent of the carriers harbored virulent diphtheria bacilli, and on this basis there occurred only one case of clinical diphtheria for every four carriers of virulent organisms.

A striking feature brought out by the inquiry into the past history of the 49 bacillus carriers was that only three gave a history of ever having had diphtheria, and the virulence tests showed that none of these three harbored virulent organisms at the time of our examination. A more striking feature was that none of the 49 carriers, not even the 10 with virulent bacilli, subsequently developed diphtheria during the period of observation, and no case of diphtheria could be discovered among the most intimate associates of these carriers.

We are led to ask, Why do they escape? Certain it is that not every person whose throat culture shows virulent diphtheria bacilli develops clinical diphtheria. The Klebs-Loeffler bacillus has so long been accepted as the ætiological agent of diphtheria that it is a daring act to call it into question. We do not of course question its causative relationship to the disease, for the results of antitoxin therapy alone establish this beyond any doubt, but the disproportion between the number of bacillus carriers and the incidence of the disease requires consideration. Three questions suggest themselves which seem worthy of investigation.

1. May the diphtheria bacillus be able to produce diphtheria only when growing in the throat in symbiosis with a certain other organism or combination of organisms?

2. May the diphtheria bacillus be unable to produce diphtheria if a certain other organism or combination of organisms is present in the throat?

3. Do certain persons possess an immunity against diphtheria without ever having had the disease?

Methods of experimentally approaching these questions readily suggest themselves.

It is evident that we have not enough data as yet upon which to decide the important question as to what measures sanitary authorities should adopt toward healthy diphtheria bacillus carriers. These naturally divide themselves into two groups: (*a*) Those with virulent organisms; (*b*) those with avirulent organisms. With regard to the latter, we are unable to say whether they constitute a meance to the community, until we know whether, and under what conditions, the organisms present may acquire virulence.

With regard to the first group, those with virulent organisms, it is probable that they are the source of supply for the bacilli encountered in the cases of clinical diphtheria which occur and are therefore a source of danger to the community. Owing to the inadequacy of our present knowledge of the epidemiology of diphtheria, and since this group occupies a position of suspicion, it would be desirable to safeguard the community against any danger which it may constitute. Isolation of the entire group is an impracticable measure, since the number is far too large, 3,696, on the basis of our figures for a single examination in a city the size of Baltimore. Even the determination of the individuals forming this group is an undertaking which would not be lightly entered upon by any board of health.

Isolation being impracticable, sterilization suggests itself. The difficulty encountered here is that no efficient means of ridding an individual of diphtheria bacilli is known. Modern therapy presents few, if any, more potent curative agents than diphtheria antitoxin, and its results in curing diphtheria are too well known to require comment. Patients cured of diphtheria by means of antitoxin, or any other therapeutic agent, or undergoing spontaneous recovery, usually get rid of the diphtheria bacilli along with the disease, but, in not a few recovered cases, the bacilli persist, and this persistence is probably as frequent in cases recovering after the use of antitoxin as in those who receive no antitoxin.

While we have no statistics on the above point, our experience with the use of antitoxin in bacillus carriers, as well as the result of a considerable amount of experimental work done on animals,[3] is in accord with the experience of others, who agree that, while invaluable for the cure of diphtheria, antitoxin, subcutaneously or locally, is useless for the eradication of diphtheria bacilli.

Some of the problems which seem urgently to demand solution are:

1. May avirulent diphtheria bacilli become virulent, and under what conditions?

2. Under what conditions may virulent diphtheria bacilli cause clinical diphtheria?

3. How may the sterilization of diphtheria-bacillus carriers be accomplished?

Until these problems have been solved, or, at least, until the solution of the third one has been accomplished we are scarcely in a position to deal with the healthy diphtheria-bacillus carrier. This does not mean that the rigorous measures usually adopted against cases of clinical diphtheria should be relaxed. Whatever may be the menace from the healthy carrier of either virulent or avirulent diphtheria bacilli, experience has taught the very real danger of cases of clinical diphtheria in giving rise to spread of the disease. Here we are dealing with a danger which is recognized, and the strictest precautions should be taken. The usual regulations of isolation of the patient, quarantine of the house, requiring repeated negative cultures from nose and throat, and disinfection of the house before raising the quarantine, should be enforced, for it is not improbable that the diphtheria bacilli which have just been derived from a case of clinical diphtheria may differ in some way from even the virulent bacilli found in healthy carriers or may be associated with other organisms which render them more dangerous.

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[1] At the time these cultures were taken the medical school was closed and the hospital quarantined on account of cases of diphtheria occurring in the latter.' The investigation of the student boarding houses was undertaken at the direction of the city board of health. The cultures were examined in the laboratory of the health department, and we are indebted to Drs. Jas. Bosley, commissioner of health, C. Hampson Jones, assistant commissioner of health, and W. Royal Stokes, city bacteriologist, for permission to use the above figures, and for their thorough and generous cooperation in this entire investigation.

[2] This part of the investigation was carried on by Mrs. H. E. Knorr, R. N., one of the school nurses acting under the direction of the city board of health, and we are indebted to her for most thorough and intelligent cooperation in our work.

[3] Studies on Diphtheria II. Now ready for publication.

DISCUSSION.

Dr. SCHATTENFROH: In discussing what should be done with bacillus carriers, Schattenfroh believed that by means of internal and local chemical treatment we should probably eventually achieve the desired results. So far as laws on the subject are concerned, the speaker discussed the new quarantine law in Austria. According to this, bacillus carriers are to be regarded exactly like persons ill of contagious diseases, or like suspects. There will never be any difficulty in carrying out such laws in exotic diseases, even though bacillus carriers are more numerous than the sick. But in dealing with ordinary infectious diseases, there are very great difficulties. It is especially for these that a successful treatment of bacillus carriers is the end to be aimed at.

Dr. S. UNTERBERGER: Aus den Discussionen über radicale Behandlung der Bazillenträger ersieht man, dass wir bis jetzt keine Mittel, weder äussere noch innere besitzen, um die Menschen von den Bazillen zu befreien. Es bleibt somit für's erste nichts anderes übrig als den Menschen zur individuellen Reinlichkeit zu erziehen und anzuhalten. Der Mensch muss wissen, dass Reinlichkeit in des Wortes weitestem Sinne der beste Schutz ist gegen Infection. In Reinlichkeit müssen unsere Nahrungsmittel gehalten werden, in Reinlichkeit alle Teile des Körpers, ebenso Leib- und Bettwäsche. Erzielen wir das, so haben wir das Meiste erreicht.

Dr. THEODORE THOMSON said that the discovery of the "carrier" state, and of the part that the carrier played in the dissemination of disease, was one of the most important additions, in recent years, to epidemiological science. It had added much to our knowledge, and knowledge was the first essential condition to ultimate control of infectious maladies. And yet, for the time, this discovery had increased administrative difficulties in the control of disease, because of the need for adapting existing administrative methods to a new condition.

He did not propose to consider the whole carrier question, but would refer, as briefly as possible, to administrative methods in relation with the typhoid carrier and the cholera carrier. In England there were no legal provisions enabling local authorities to exercise any form of control over the typhoid carrier; what was done, in the way of control, was solely by means of advice and persuasion. He did not think that the English people, with their strong regard for the liberty of the subject, would ever consent to the compulsory isolation of typhoid carriers. Moreover, he doubted whether so severe a measure as compulsory isolation was justified by the circumstances. Perhaps the existing legislation might, in some respects, be amended, as, for example, by the creation of power to prevent typhoid carriers engaging in vocations involving special risk of the transmission of the disease to the community. In this he was entirely in agreement with Dr. Ledingham, notably as regarded their employment in any connection with milk supplies. But, for the rest, he would deprecate, at all events for the present, other methods than persuasion and advice as to habits of cleanliness, of a kind calculated to diminish the risk of propagation of the disease.

The cholera carrier had, during the last two years, attracted special attention because of the extension of that disease to certain parts of the continent of Europe. Measures had, in some instances, been taken, with a view to prevent the importation of cholera into countries free from the disease, which he thought were not justified by the considerations involved. In the port of New York, for example, bacteriological examination of the stools of all third-class passengers on vessels from cholera-infected ports had been conducted over a considerable period of time. Like measures had been taken by the Egyptian quarantine board, as regards all persons on board such vessels. These measures were a violation of the International Sanitary Convention of Paris, of 1903. The position, as regards the cholera carrier, was fully considered at the international conference held at Paris toward the close of 1911, and the conference decided that severe measures were undesirable and unreasonable. In the convention drafted by that conference strictly limited powers as regards bacteriological examination of stools were inserted; the limitations applying to infected ships only and, even in these, to persons whom there was reason to regard with suspicion.

The history of these measures, as regards the cholera carrier, afforded an illustration of the principle for which England had been fighting for many years in successive international conferences; the principle that, although considerations of public health must and should take the first place, yet it is necessary and wise not to neglect other considerations. Measures of extreme severity seriously inconvenience the traveling public and not infrequently cause grave damage to commerce. Damage to commerce was not to be lightly set aside; in the ultimate resort it meant increase of poverty, and there was no greater influence, of an evil kind, upon the health and lives of the community, than poverty.

To his mind, the moral of all this was that we should consider carefully all the circumstances involved before proceeding to sanction legislative measures as regards the carrier, and that in the adoption of such measures we should proceed cautiously, and step by step.

Dr. Charles J. Hastings: We have listened with intense interest to the very lucid manner in which this important subject of bacillus carriers has been presented. It has been clearly set forth that the carriers of typhoid, diphtheria, cholera, and so forth, are, or may be, a danger to those with whom they may come in direct contact. A comparatively large per cent of outbreaks of the various communicable diseases have been traced to these carriers, yet we have not been told what we should do with them in order to more efficiently safeguard the public. I was rather surprised to hear Prof. Abbot and others say that we have no power to quarantine carriers. The public health act requires that we quarantine all cases of diphtheria, scarlet fever, cholera, et cetera, within six hours after receiving notification thereof. We don't quarantine these cases because they are sick and have clinical symptoms, but rather because they are suffering from a disease, the germs of which they may transmit to others. The same is true of the carrier. While he has not the clinical symptoms, yet, as has been clearly pointed out this morning, he is capable of transmitting the disease. In Toronto we endeavor to carry out the spirit as well as the letter of the law. We quarantine all diphtheria carriers that come under our observation, or that are reported to the department. We quarantine these as carriers, which quarantine is less rigid than for the clinical cases, the patient only being kept from coming in contact with other children. The rest of the family are permitted to go in and out and to their respective business. In the case of chronic typhoid carriers, we will probably have to be content with prohibiting them from engaging in any way in the handling or the coming in contact with food that is going to be used for human consumption. Rigid cleanliness (medical asepsis) on the part of these chronic carriers would materially minimize the danger. Inasmuch as these cases may engage in the dairying business, or in some way in the handling of milk, the latter having been a not infrequent source of outbreak, we should require all milk to be scientifically pasteurized before being used for human consumption, and so practically eliminate the danger of the carrier from this source.

Dr. Frank Warner: It has not seemed advisable to me that diphtheria bacilli carriers should be quarantined as such, but only when these bacilli are shown to be of the virulent type. If such carriers are working among food products, their employment should be changed.

Dr. Bolduan: My own experience has been largely with typhoid and agrees with what was said by Dr. Ledingham, that chronic carriers have a very large share in the production of typhoid infections. In particular, great importance attaches to the chronic typhoid carriers engaged in handling milk sold to the public. One such carrier studied by me had his typhoid fever 46 years before, had caused a large number of cases of typhoid each year in his small village, and finally was responsible for over 300 cases in New York. It is not difficult to say just what should be done with such carriers, as Dr. Ledingham has told you. No known typhoid carrier should be allowed to engage in dairying. The great difficulty at the present time is the recognition of all the carriers, and this, like so many other public health problems, is largely a question of expense.

With a city like New York obtaining its milk supply from some 40,000 dairy farms, the magnitude of a search for bacillus carriers will be appreciated. The importance of an administrative control of bacillus carriers differs considerably as to whether the carriers live in the city or in the country. In the latter the menace to the public health is in every way much greater than in city carriers. Since so large a share of every city's typhoid infections come originally from the country, we should direct our efforts mainly to the control of the country typhoid carriers.

THE TREATMENT OF DIPHTHERIA CARRIERS BY OVERRIDING WITH STAPHYLOCOCCUS AUREUS.

Mazyck P. Ravenel, M. D., director State Hygienic Laboratory, University of Wisconsin, Madison.

The treatment of diphtheria carriers by spraying the throat with cultures of staphylococcus aureus was introduced by Schiotz[1] in 1909. He was led to this by observing that a patient with sore throat due to the staphylococcus did not contract diphtheria when exposed to the disease. He observed also that several convalescents failed to give positive cultures after suffering from an intercurrent attack of staphylococcus sore throat. He treated six cases, and in all the diphtheria bacilli disappeared promptly.

Page,[2] in 1911, was the first American to make use of this treatment, having used it on one patient while in the Philippines. The bacilli disappeared from the throat on the fourth day. Later, Page[3] used cultures of staphylococcus on his own child in an acute case of diphtheria. On the fourth day all treatment was suspended, as the throat gave a negative culture. The diphtheria bacilli appeared again on the fifth day. Treatment with the staphylococcus was resumed on the seventh day, and on the next day cultures were again negative for the diphtheria germ. From this time on the child made an uninterrupted recovery.

In 1911, on the advice of Dr. Harris, of Chicago, Catlin, Scott, and Day,[4] of Rockford, Ill., successfully used staphylococcus in eight cases.

Lydia M. De Witt[5] has carried out an extensive series of experiments in animals. She reports that of 32 animals inoculated with diphtheria, and afterwards treated with a staphylococcus culture, 9 were apparently not influenced by the treatment, 14 were worse, and 9 better. De Witt concludes that there is no rational basis for treating diphtheria cases with staphylococcus aureus. She also reports two cases of sore throat in which diphtheria developed, and, in one, gained and kept the ascendancy. De Witt admits, however, that the animal experiments indicate that a certain percentage of acute cases may clear up more quickly under staphylococcus treatment than under ordinary antiseptic treatment.

During the winter of 1912 a troublesome outbreak of diphtheria occurred in the State Hospital at Mendota.[6] After the usual treatment had failed entirely, I suggested to Dr. Lorenz, the physician in charge of the cases, that the staphylococcus spray be used. He consented, and we supplied the material from the State Laboratory of Hygiene of Wisconsin. In studying the cases subsequent to the use of the spray, every effort was made to rule out the personal equation. At our request, the swabs were taken by Dr. Lorenz and sent to us without any intimation as to whether they had been treated with staphylococcus or not. The notes on the cases treated were made entirely by Dr. Lorenz.

In all, 17 patients were treated, and these may be divided into three groups. The first group (3 patients) were carriers pure and simple; that is, they never showed clinical manifestations of the disease, either local or constitutional. The results in group 1 were uniformly good. In two cases, the bacilli disappeared from the throat entirely after six applications of the spray. Three months later, one of these persons again became a carrier, and the reinfection was cured rapidly by the use of the spray. Another case did not clear under the staphylococcus spray of the throat, but, after a combined nasal and throat application, negative results were speedily obtained.

Nine combined applications were made on three successive days. These patients were attendants on duty in the isolation ward, and had never shown clinical manifestations of diphtheria.

The second group (6 patients) had suffered from diphtheria, and remained carriers after clinical recovery. From 5 to 25,000 units of antitoxin had been used on these patients. The local treatment consisted of hot saline douches every four hours, alternating with a spray of Dobell's solution, permanganate potassium solution, chlorin water, or bichloride of mercury. In spite of this treatment, the throats continued to harbor the diphtheria bacillus long after clinical recovery; in one case, as long as nine weeks.

With the beginning of treatment by the staphylococcus spray, the local antiseptic treatment was discarded. Four of the cases cleared up within one week; in two cases the results were not so good, the throats giving negative cultures one day, and returning to positive the next, or the next but one. In one of these cases there remained apparently a focus of infection in the nasopharynx, while in the other it seemed unquestionable that a large spongy tonsil was responsible for the maintenance of infection. Both were finally cured by persistent use of the staphylococcus spray combined with the use of antiseptics.

The third group of cases (8 patients) were those of clinical diphtheria, in which the spray was used early as a method of treatment. Every patient received antitoxin, but locally no treatment other than staphylococcus was used, with one exception. In four of these cases the results were excellent; that is, the diphtheria bacilli disappeared from the throat within one week, and after from 4 to 8 applications of the spray. The entire duration of the quarantine in these cases was from 6 to 14 days. In three cases the results were fair. Usually, after 6 or 8 applications of the spray, the diphtheria bacilli could not be found in cultures taken from the throat, but after several days a few diphtheria germs would again appear. The duration of these cases, before becoming permanently free of the bacilli, was 20, 22, and 36 days, respectively. The last case was a mild one, and, after following a course as described above, namely, negative results one day, followed by positive soon after, the staphylococcus spray was abandoned, and a one to two-thousand solution of bichloride used. After six applications of this, cultures taken from the throat showed the diphtheria bacilli in almost pure culture. The use of the spray was resumed, and on the thirty-ninth day the case became permanently free from bacilli.

We give here several typical cases:

Case 1.—The patient, W. F. D., a student at the University of Wisconsin, became ill with diphtheria on February 5, 1912. Antitoxin was administered, and clinical recovery was prompt, but diphtheria bacilli persisted in the throat. On the twenty-sixth day Dr. H. M. Kay, the physician in charge. asked advice concerning the matter. We recommended to him the use of the staphylococcus spray. This was supplied to him in the form of a 12-hour-old culture in bouillon, the directions being to spray it thoroughly into the throat and nares. Thirty-six hours later a culture taken was negative to diphtheria, and five consecutive cultures remained negative. In this case the action of the staphylococcus spray was rapid and permanent.

Case 2.—X., a boy aged 13, was taken out of school, as he was found to be carrying an almost pure culture of Klebs-Loeffler bacilli. As the condition persisted for over two weeks, Dr. J. M. Furstman, health officer of La Crosse, consulted the State Hygienic Laboratory, and cultures of the staphylococcus 15 hours old were sent to him. The throat was sprayed every second day and cultures made to determine the effect of the last treatment. At the third spraying the number of diphtheria bacilli was very much decreased. The fourth culture also showed diphtheria bacilli, but four subsequent cultures remained negative.

Case 3.—In a factory in the city of La Crosse, owing to an outbreak of diphtheria, the throats of approximately 350 operatives were examined. Six carriers were found and isolated. Five of these cleared up under ordinary treatment within a week. The diphtheria bacilli persisted in the sixth patient, a woman aged 19. Dr. Furstman began the use of the staphylococcus spray, using it, however, only every second day. Two cultures from the throat after the beginning of the spray were positive, but after that all cultures taken remained negative.

Cases 4 and 5.—Under the care of Dr. Karl W. Smith. Two children, both of whom were suffering from enlarged cervical glands, one certainly and the other probably due to tuberculosis, had clinical diphtheria, as far as the presence of membrane was concerned. The general symptoms, however, were very mild. Both received antitoxin, which was followed by rapid disappearance of the membrane, but cultures taken from the nose and throat both continued to show positive diphtheria. After nine days the use of the staphylococcus spray was begun. Within four days cultures from the nose became negative and remained so. In cultures from the tonsils a few diphtheria bacilli persisted. After more than a week of this treatment the tincture of chloride of iron was used as a gargle. The bacilli, however, persisted for six days under this treatment, after which a return to the staphylococcus spray was made. Within six days the diphtheria bacilli disappeared and the throats remained permanently free. In these cultures very few diphtheria germs could be found during the use of the spray. Evidently here the enlarged tonsils played a part in maintaining the infection. One effect of the staphylococcus spray was apparently a rapid and marked decrease in the size of the tonsils.

The result of our experience in these cases has taught us a number of points. At first we were fearful that bad results might follow the use of the virulent staphylococcus, and the spray was used very cautiously. In later cases the spray has been more freely employed, and our results have been much better. We now advise the use of the spray three times a day in the nasopharynx and over the tonsils and throat, continuing it until the surfaces are thoroughly wet. We have had no untoward results whatever. Three patients have developed a coryza during the use of the spray and one a very mild laryngitis. In two, small furuncles have developed at the tip of the nose. Whether or not these results were attributable to the spray is not known.

We have found that the condition of the tonsils influences our results markedly, the large spongy tonsil apparently harboring diphtheria germs deep in the crypts, where they persist in spite of treatment. In these cases good results appear to have been obtained by massage of the tonsil before the use of the spray. In every case in which the tonsils were approximately normal the diphtheria bacilli have rapidly disappeared from the throat under the use of the staphylococcus spray alone.

We have tried several strains of staphylococcus, some highly virulent and some feebly so. We have also tried mixing the strains, but have not been able to detect any difference in the action of the various cultures, though our experience is not great enough to warrant a sweeping conclusion on this point.

Two methods of preparation have been employed, with equally good results. In one, bouillon cultures from 12 to 18 hours old are used, while in the other the cultures are grown on agar slants and the growth suspended in normal salt solution. The latter method offers some advantages when the material has to be shipped and when a very heavy suspension of the staphylococcus is needed. Any good hand atomizer works well.

As a result of these observations, the following conclusions seem justified:

First, that the use of the staphylococcus spray is a simple and effective means of ridding the throat of carriers of diphtheria germs.

Second, that in convalescents the use of the spray hurries the disappearance of the germs.

Third, that in acute cases the spray seems to exercise a beneficial effect.

Fourth, that the spray should be used abundantly both in the nose and over the tonsils.

Fifth, that the procedure is free from danger.

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[1] Schiotz: Ogeskr. f. Laeger, 1909, lxxi, No. 49; abstr. in The Journal A. M. A., Jan. 29, 1910, p. 422.

[2] Page, H.: Arch. Int. Med., Jan. 15, 1911.

[3] Page, H.: N. Y. Med. Journal, Dec. 23, 1911.

[4] Catlin, S. R., Scott, L. C., and Day, D. W.: The Journal A. M. A., Oct. 28, 1911, p. 1452.

[5] DeWitt, Lydia M.: Jour. Infect. Dis., January, 1912.

[6] Lorenz, W. F., and Ravenel, M. P., J. A. M. A., Aug. 31, 1912.

VACCINE TREATMENT OF CARRIERS OF DISEASE.

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We shall outline our conception of the immunity problem involved with bacteria carriers, and make a preliminary report on the work we are doing with these cases.

Bacteria carriers have been observed for diphtheria, typhoid fever, Asiatic cholera, epidemic meningitis, and gonorrhea. In a certain sense, syphilis, malaria, and trypanosomiasis may be considered in the same category. We define a bacteria carrier as a healthy person who harbors, for an indefinite period, an organism, which, when the opportunity arises, will produce the disease of which the organism is known to be the etiological factor. Sometimes the person has suffered from the disease, and at other times he has not. The person serves to perpetuate the organism in the community. When such a person has been discovered the next important question arises: What shall be done to cure the carrier?

When a person recovers from an infection, the body itself usually destroys the invading organism. The person subsequently becomes briefly or permanently immune. During the last few years, a great amount of work has been done in the attempt to determine the exact processes involved in the mode of attack, the methods of defense, and the recovery. In order to understand the problem of how to cure a carrier, it will be necessary to examine closely the organism in question, its mode of attack, and the forces which the body uses to repel the invasion. It will be our problem to inquire what error in the mechanism of defense has occurred, that the body should recover, and yet be unable to rid itself of its unwelcome guest. Then we shall try to determine whether the faulty mechanism may be repaired.

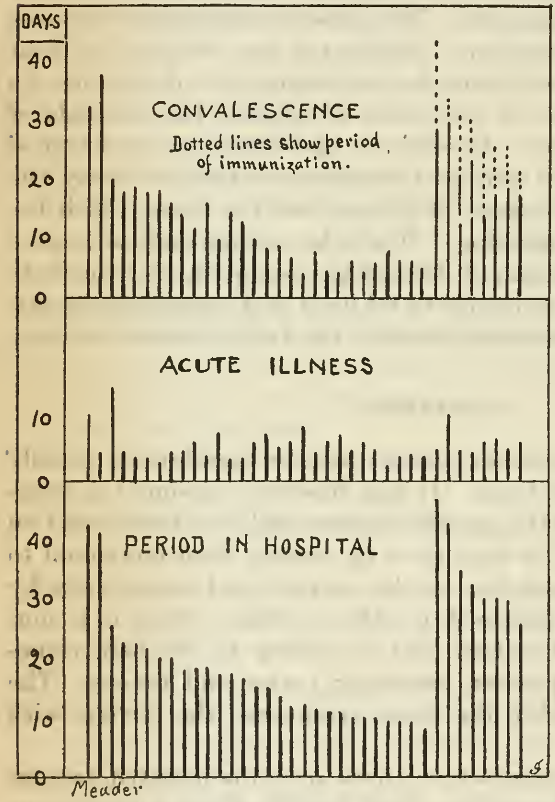
DIPHTHERIA.

Loeffler's diphtheria bacillus attacks mucous membranes, usually of the upper respiratory tract. It has, however, produced a pneumonia, an ulceration on the gastric mucosa, and has been found on the vaginal mucosa. It is kept alive by passing from individual to individual, usually through the air, by contact, and occasionally by means of milk. Some people it is able to affect, others it is not. The infection remains localized and, according to Ehrlich, elaborates several kinds of poisons, especially toxins and toxons. The toxins are associated with the toxic symptoms, the toxons with paralysis.

The body's mode of defense is to throw over the irritated area an exudate of serum and leucocytes, which quickly forms a membrane. Phagocytosis occurs, and many other diphtheria organisms are destroyed by the bacteriolysins present in the serum. The poisons excreted by the bacillus stimulate the body cells to elaborate an antitoxin which neutralizes the toxin. So long as this mechanism of defense is complete, the patient completely recovers. But we frequently find systems in which no toxic symptoms occur, or in which the toxic symptoms quickly disappear, but the organism persists. We can explain the situation by either of the following means: (1) Bacterial antibodies, such as bacteriolysins and opsonins, fail to develop; (2) the organism may not form poisons; (3) if poisons are formed, it may be that suitable receptors are not present in the cells of the body.

The defect that particularly interests us is that in regard to the elaboration of the bacteriolysins and opsonins. The first point is to inquire if they are elaborated in the case of carriers, and if not, to inquire if their production may be stimulated artificially by vaccines. For a preliminary report, it may be stated that at our city hospital, during last September and October, there were 37 cases of diphtheria, 8 cases of which had a convalescence of 15 to 30 days before treatment was begun. The patients were given subcutaneously about 100,000,000 stock diphtheria vaccine. If, in 24 hours, there was no local reaction, the dose was doubled. On the other hand, if there was a reaction, it was allowed to subside before repeating the dose. As a result, on the eight cases mentioned the diphtheria organisms disappeared, on an average, in 7 days. (See Diagram I.)

I Immunization of Diphtheria Carriers.



This is no new experience. Petruschky has had a similar result, but he has also had a case which required vaccination at intervals during 15 months before cure could be obtained.

The step in immunization which needs investigation is the influence of the work on the antibodies. This is the work we are attempting at the present time.

TYPHOID FEVER.

Eberth's bacillus of typhoid fever is kept alive in the bodies of men, and spreads from man to man. The means of conveyance may be by direct contact or by eating contaminated food. The chief point of attack is the intestinal tract. During the early part of the illness, the organism is in the blood stream, and may become localized in the lungs, meninges, or bones. It does not elaborate a soluble toxin, but apparently produces an endo-toxin which produces the toxic symptoms.

The body's method of defense is chiefly the elaboration in large numbers of bacteriolysins. So numerous may they become that they have been demonstrated in blood diluted four million times. In all typhoid cases this elaboration apparently occurs. So far as I know, the amount of bacteriolysins developed in a patient who subsequently becomes a carrier has not been determined. We do know, however, that the bactericidal power of the blood of a chronic carrier is about that of a normal person.

In the presence of strong bactericidal sera, where laboratory strains have been shown to be readily killed, it has been observed that the particular strain affecting the patient has been found to persist for some time. This explains why the bacteremia persists so long. Manifestly, the infecting strain may develop an ability to defend itself, which ability may be lost by cultivation on an artificial medium.

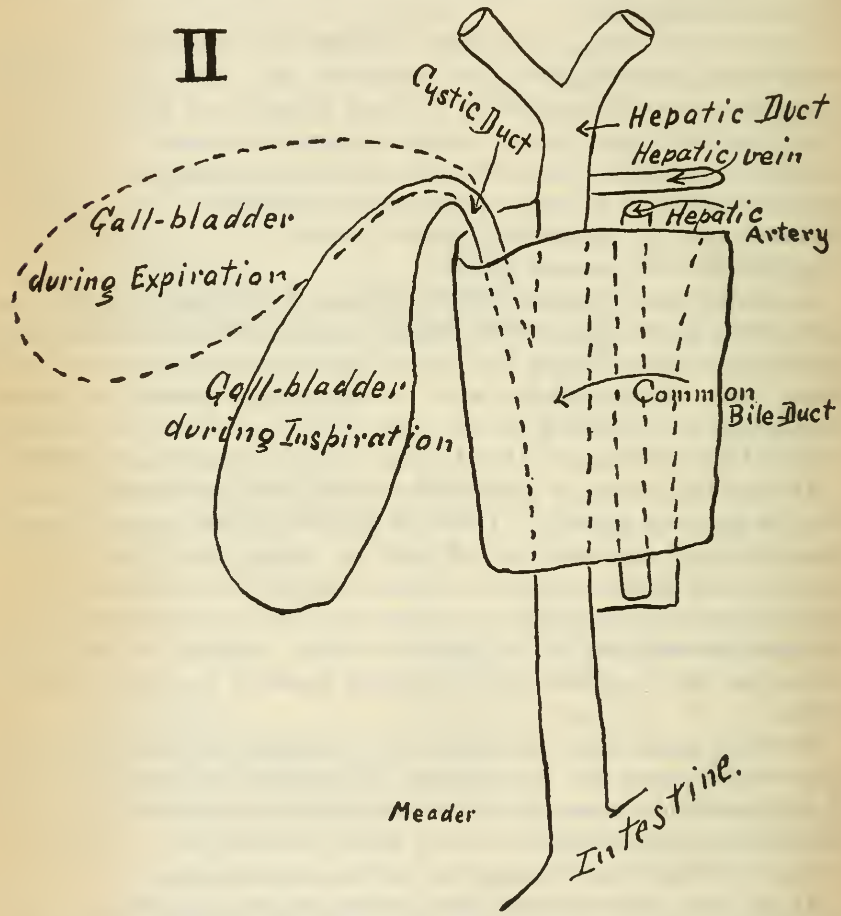
During the course of typhoid fever this high bactericidal power may be lost very quickly. If some of these organisms escape through the bile capillaries into the gall bladder during the period of bacteremia, and divide at the rate of once every 20 to 30 minutes, since bile is an excellent pabulum, one can see how the gall bladder may become infected, and the organisms become sheltered in the thick walled sac, and be discharged at irregular intervals into the intestinal tract.

If such a person is so immunized that the blood attains a very high bactericidal power for the organism in question, one can see how, if the bactericidal power should be high enough, organisms in the gall bladder or other recesses of the body might be destroyed. The height of the bactericidal power seems to be the important point.

It has been observed that adult women become carriers more frequently than men; hence, it has been suggested that some anatomical arrangement may be responsible. The following simple anatomical explanation may be useful to show why they remain in the gall bladder:

At the end of expiration, the dome of the diaphragm, on the right side, is opposite the upper border of the fourth rib. Its excursion downward during inspiration is about 1 inch. The liver is attached to the under surface of the diaphragm by the coronary, right and left lateral, and suspensory ligaments. The under surface of the liver is connected with the stomach by a fold of the peritoneum which incloses the hepatic artery, portal vein, and bile duct. This is called the gastrohepatic omentum, and an inspection of a cadaver will convince the observer that the part is quite fixed. The gall bladder is attached to the under surface of the liver by areolar tissue. It is a sac which hangs down to the free border of the liver, and at the upper end, it narrows to a spiral duct containing the valves of Heister. This duct bends sharply as it enters the right free border of the gastrohepatic omentum, and, after passing parallel with the hepatic duct for some distance, unites with it, and forms the common bile duct. (See Diagram II.)

II



During inspiration the dome of the diaphragm descends about 1 inch; hence, the gall bladder descends likewise, making the bend in the cystic duct more and more acute, and increasing the resistance to the onward flow of bile. During expiration the diaphragm, liver, and gall bladder rise, making this bend in the cystic duct at a less acute angle, approaching a right angle, and relieving somewhat the resistance to the outward flow of bile. The gall bladder is surrounded by a band of plain muscle fibers which causes the gall bladder to con-

SHOWING CHANGE IN BACTERICIDAL POWER OF A TYPHOID CARRIER DURING IMMUNIZATION

III

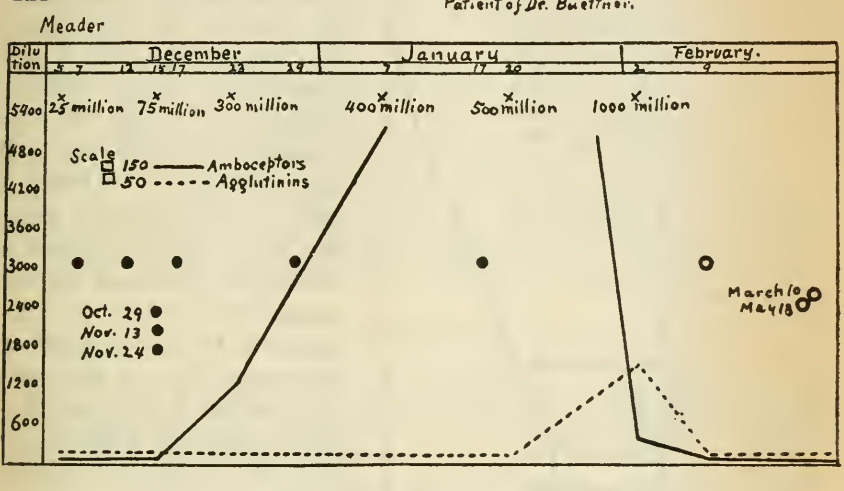
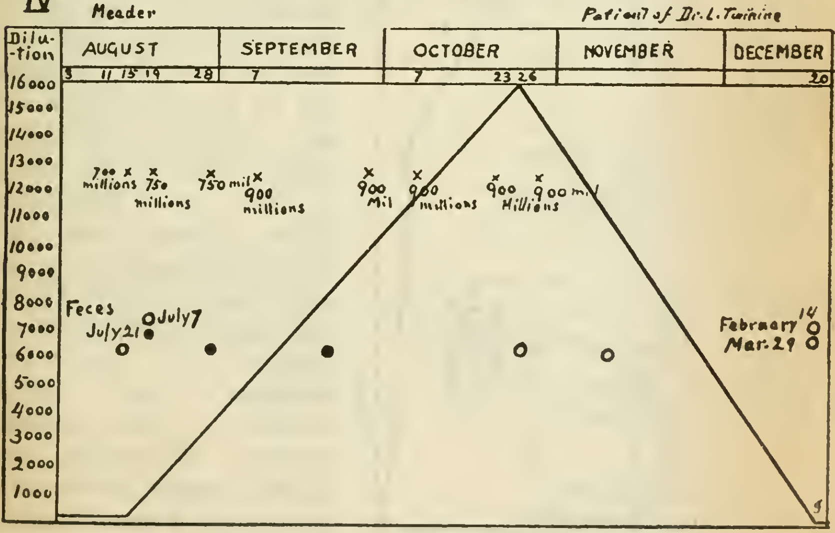


Diagram showing changes in Bacterial Amboceptor content of the blood of a typhoid carrier during immunization with autogeneous vaccines.

IV



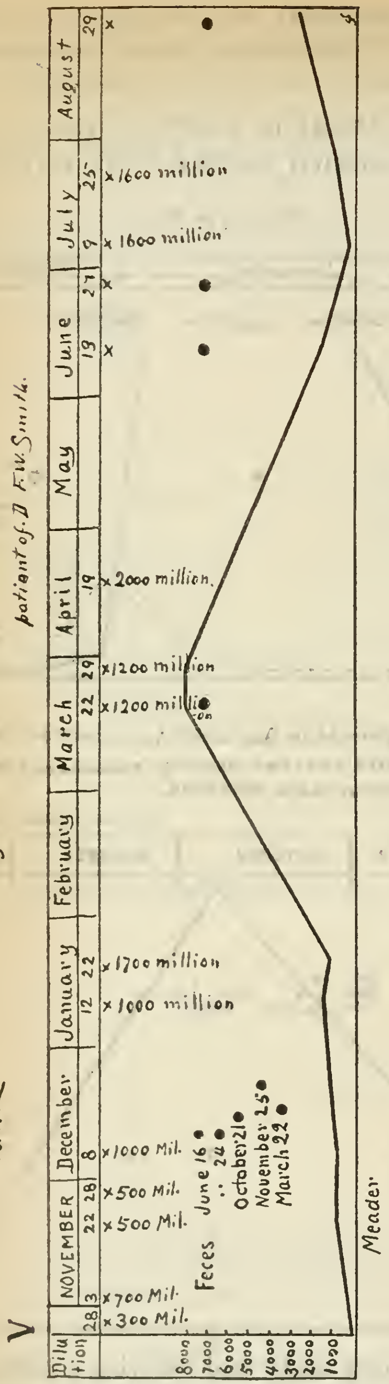


Diagram Showing Changes of Bacterial Amboceptor Content of the blood of a Typhoid carrier during immunization with autogenous vaccines.

tract. The characteristic movement of this kind of muscle, plain muscle, however, is very slow and not very tense, with long intervals between contractions. The hydrostatic pressure of the bile is not very great, only about that of 22.5 centimeters of water. While digestion is going on the muscular coat of the gall bladder is active. During a period of contraction, when the bile is under pressure, a release in resistance to the onward flow of bile, by a decrease in the acute angle of the cystic duct at the right free border of the gastrohepatic omentum, would allow the bile to escape. Thus, during abdominal respiration, the rythmical rise and fall of the gall bladder would enable more of the bile to escape than when held in a fixed position. Physiologists tell us that men normally have abdominal breathing, while adult women chiefly have costal breathing. Hence, it would seem that if the gall bladder becomes once infected, and if it is by any means hindered from frequent and complete drainage, it might remain infected for long periods of time. We should then expect women to be carriers more frequently than men.

I have had an opportunity to study three typhoid carriers. In the first two, the bactericidal titre became very high when the typhoid organisms disappeared. The first case was followed for a year. Her gall bladder was carefully examined after death and no trace of typhoid organisms was found. (See Diagram III.) The discs indicate samples of feces in which typhoid organisms were found. The circles indicate samples of feces in which typhoid organisms could not be found. The second case became clear last December. We have not been able to find typhoid organisms since. (See Diagram IV.)

A third case has been studied for over a year. Bactericidal power has been less than half as high as in the other cases, and the stools have not become free of typhoid organisms. The process of immunization in this case has not been so well done as in the other cases, which may explain the lack of success. (See Diagram V.) The details in regard to doses of vaccine, interval, and amount of bacteriolysin in the blood may be determined on the charts.

DISCUSSION.

Dr. W. J. Lumsden: We have heard from Prof. Meader a very interesting report on the results of treatment of typhoid-bacillus carriers with autogenous vaccines.

The results constitute, I think, an important contribution to the literature of this very important phase of typhoid prevention.

While some bacillus carriers have not responded favorably to any of the various treatments such as the use of vaccines, administration of urotropine, and surgical interference, it seems well worth while to try autoginous vaccines as a means of effecting a cure of typhoid-bacillus carriers.

Dr. John A. Ferrell: Has there been devised a simple method for examining stools, outside of the laboratory, to determine whether or not a person is a typhoid carrier? In our hookworm campaign, we frequently examine one-fifth to one-third of the inhabitants of the various counties, to ascertain if they are hookworm carriers. If it were possible to incidentally examine these persons also with regard to carrying typhoid bacilli, we could do much toward eradicating the disease by giving inoculations to the carriers found.

THE PART PLAYED BY FLIES AND OTHER INSECTS IN THE SPREAD OF INFECTIOUS DISEASES IN THE TROPICS WITH SPECIAL REFERENCE TO ANTS AND TO THE TRANSMISSION OF TR. HIPPICUM BY MUSCA DOMESTICA.

Dr. S. T. Darling, Ancon, Canal Zone.

I was desirous of determining the likelihood of ants acting as carriers of infectious disease of bacterial origin, and had a number of experiments carried out to determine this point. One can readily see the danger of our situation if ants acted as carriers of pathogenic microorganisms, for it is absolutely impossible to keep them out of the house, and they get into food, in spite of all our efforts. If this were all, it would not matter much, but they get into other things as well. During the dry season, they visit the water-closets and bathroom in search of water, and the winged forms of ants fly where they cannot creep. In fact, it would seem as if there were not a point on the earth's crust within the Tropics that is not carefully inspected within the course of an hour by some industrious, persistent, and inquisitive ant.

Traps baited with sugar were placed about, and several of the common species collected and fed with typhoid bacilli. After dissection, in no instance was it possible to cultivate *B. typhosus* or any other microorganism from the intestinal tract of the ants. Determinations were now made of the formic-acid content of the head, thorax, legs, and abdomen, and, so far as could be ascertained by chemical tests, formic acid was absent in the head and thorax, but was present in the abdomens to the amount of 3.51 per cent, or 1.43 per cent of the entire body weight. These determinations were made from the large yellow ant: *Camponotus landolti*, Forel, subspecies *zonatuc* Emery. Another species, *Tetramorium guineense*, was examined and found to contain 2.1 per cent of formic acid by weight.

Number of ants	49
Weight per ant	.00083
Free acidity as formic acid per ant	.000018
Per cent of free acid	2.1

Combined acid, none perceptible.

Seventy-six ants of another lot were similarly examined, and found to contain 1.3 per cent free acid and 7.5 per cent combined acid. It is seen, then, that the common ants may contain from 1 to 4 per cent of formic acid, the germicidal value of which is four times as great as carbolic acid, and it would appear that ants may effectually sterilize bacteria in their food.

A further experiment was carried out, in which it was found that when ants were immersed in a broth culture of *B. typhosus*, then permitted to crawl over filter paper within a Petri dish for five minutes, and afterwards placed in a sterile Petri dish lined with filter paper, they were able, as long as 24 hours after removal from the broth, to infect culture media by simply creeping over it. In this way, the ant is capable of acting as a mechanical carrier of *B. typhosus* on its legs, and this is incriminating evidence against the ant as a potential carrier of pathogenic bacteria.

These experiments were conducted by my assistants, Messrs. Bates, Jacob, and Jennings.

Recently, I have been very much interested in the question of the transmission of trypanosomiasis of horses by means of the common, unspeakable, or typhoid fly—*Musca domestica*. We had a visitation of this disease (murrina) among the corral mules and work horses in 1909. As it was chiefly among the mules, naturally the disease was not transmitted during copulation. Ticks did not transmit it, for mules were never infested with ticks, although the saddle horses frequently were. The latter, however, never contracted the disease naturally. Among the biting flies, Stomoxys and Tabanidæ could not be incriminated, because Stomoxys were biting mules and saddle horses indiscriminately, yet the saddle horses, though just as susceptible as the mules, never contracted the disease. Tabanidæ were rarely found at all, excepting in the woods, and it appeared that they were never found in some of the districts where the trypanosomal disease existed. There was no testimony tending to incriminate any other insect than the unspeakable fly.

I found that excoriated patches on the skin of the animals appeared several days before death, and resulted from the animal's leaning against the stall. These sores exuded infected serum, and were constantly visited by flies. It was found, too, that the animals which became infected with the disease had, as a rule, been worked on "scrapers," and that they were frequently in the sick corral suffering from cuts and galls. It seemed reasonable that the flies acted as carriers of the disease by transporting the trypanosome from the sores of infected animals to the fresh cuts of clean animals.

I am aware that it was not very dignified, if I may so express it, to attempt to incriminate *Musca domestica* when most trypanosomal diseases are known to be transmitted by biting flies; or, at least, such flies have been accused of acting as carriers of the virus of several of these diseases. Very laborious efforts are made everywhere to incriminate biting flies, and there can be no doubt of this mode of infection in sleeping sickness and nagana, but there is much evidence that trypanosomiasis may be transmitted in several ways, and I would suggest that more attention be paid to the possibility of infection in some of these diseases by means of *Musca domestica*.

As there seemed to be no other way for the mules and work horses to become infected, and as this offered a good working hypothesis upon which to base a rational mode of prophylaxis, it was determined to carry out an energetic campaign based on that hypothesis. The following recommendations were made with a view to the detection and isolation of all infected animals: The isolation of all suspects in screened stables; the diagnosis of infected animals in the laboratory, by microscopic examination and animal inoculation; the sacrifice of all infected animals; and the protection of all noninfected animals by suitable dressings for their wounds. At this time about 35 infected animals had been detected, and the precautionary measures were at once carried out.

Opportunity occurred later for the collection of experimental data with a view to determining the mechanism of the infection by flies. First it was ascertained that *Musca domestica* could transmit or carry the trypanosome in the manner supposed. Three lots of *Musca domestica* were caught in biting jars and fed with blood from a guinea pig infected with *Tr. hippicum*, the pathogenic agent of the disease, and, after an interval of about 30 seconds, the flies were placed over the shaved and scratched skin of three mules, where they remained for about five minutes. One of the three mules became infected in this way.

If the mouth parts of a fly are compressed onto a slide, a large amount of clear fluid is exuded. This fluid, I have found, at times contains many individuals of the preflagellate phase of the *Herpetomonas* of the fly. It seems likely, then, that the salivary (?) secretion of the fly, which is a favorable medium for the growth of a flagellate, would not be inimical to the trypanosome.

This salivary secretion seems to be used for several purposes. Graham-Smith states that when a fly is feeding upon sugar or dry sputum, he first appears to deposit quantities of this saliva from his proboscis, making the dry substance moist, and then sucking up the solution of sugar or suspension of sputum. He further noticed that flies regurgitated clear fluid from their beaks, and that they or other flies frequently sucked up these drops into their beaks again.

In another experiment I determined that when *Musca domestica* was fed with guinea-pig blood infected with *Tr. hippicum*, the trypanosomes remained viable microscopically in the mouth parts of the fly for as long as two hours. No observations were made at this time on the extreme length of time they might so live, for as the fly was regarded as a mechanical vector, and not as a true intermediary host, it was conceived that two hours would give more than ample time for the transference of the virus from one animal to another. It was further determined that the trypanosome remained viable for inoculation purposes in the mouth parts of the fly for 23 minutes, by finding that white mice inoculated with a suspension of material from the mouth parts of infected flies became infected when inoculated 23 minutes after the feeding. This period would certainly have been found to be longer if the experiment had been so modified that the sub-inoculation from infected flies had been made into larger

mammals, for most of the mice died of septicæmia as a result of the contaminating bacteria in the proboscis of the unspeakable flies.

I have been able to confirm a number of Graham-Smith's observations on the habits of flies. It is certainly true that they regurgitate or expel infected material per anum, for I have found drops of blood that had been expelled one and one-half hours after the flies had been fed on infected guinea-pig blood. It would seem, then, that either regurgitation or expulsion of material infected with trypanosomes upon the fresh cuts or sores of clean animals is the mechanism by which infection has arisen.

We can not assume that after feeding flies absent themselves, for they are frequently interrupted in their feeding operations, and, as Graham-Smith has shown, they regurgitate or expel frequently when interrupted.

In any case, the efforts to stamp out the disease among the corral animals by efforts used against the fly and based on the conception of the part they played as carriers of the virus, was eminently successful, for the disease has been stamped out in the corrals and has not reappeared in two years, though it is still rife nearby in the outlying districts of the Republic of Panama.

MOUCHES ET AUTRES INSECTES PORTEURS DE MALADIES INFECTIEUSES.—RAPPORTS ENTRE LES MICROORGANISMES ET LES INSECTES QUI LEUR SERVENT D'HÔTES.

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Depuis 1907, époque du dernier Congrès International d'Hygiène, un grand nombre de travaux ont été consacrés au rôle des insectes, des invertébrés en général, piqueurs et suceurs de sang, dans la propagation des maladies infectieuses. Ces travaux ont fait connaître de nouvelles maladies convoyées par des invertébrés, et ont aussi beaucoup précisé nos connaissances sur la façon dont les insectes, dont le rôle était déjà partiellement connu, accomplissent ce rôle. En plaçant ces acquisitions nouvelles de la science dans le cadre de nos connaissances antérieures, nous répondrons du même coup aux deux questions posées par les Sections I et V du Congrès de Washington et pour lesquelles un rapport nous a été demandé.

I. LISTE ZOOLOGIQUE DES INVERTÉBRÉS CONVOYEURS.

Nous comprendrons dans cette liste, non-seulement les invertébrés convoyeurs de maladies de l'homme ou des animaux domestiques, mais encore ceux qui transportent des infections d'animaux sauvages ou sans utilité. Notre liste sera ainsi plus complète et elle aura l'avantage d'appeler l'attention sur des groupes zoologiques dont l'importance pratique peut apparaître quelque jour.

Diptères.—Ce sont les insectes de ce groupe qui convoient le plus d'infections. Nous citerons en tête la famille des Culicidæ, ou moustiques, en raison du rôle considérable et étendu à un grand nombre de maladies qui lui appartient. Ce sont en effet les moustiques de la sous-famille des Anophélins qui convoient les *Plasmodium* du paludisme. Le fait est démontré depuis la fin du siècle dernier et il n'y a plus lieu d'y insister. Les *Plasmodium* (*Proteosoma*) des oiseaux sont transmis aussi par des Culicides, en particulier par le *Culex pipiens,* ainsi qu'il résulte des mémorables recherches de Sir Ronald Ross.

Les Culicides doivent jouer un rôle dans la propagation des trypan. aviaires. Il est possible qu'ils aient aussi quelque rôle (mécanique) dans la transmission des trypanosomiases de mammifères, et en particulier de la maladie du sommeil. Mais l'importance de ce rôle, s'il existe, est indéterminé.

La *Filaria Bancrofti,* de beaucoup la plus importante des filaires humaines, est convoyée par diverses espèces d'anophélines et de culicines. Il en est de même des *Fil. immitis* et *repens* du chien.

Le *Stegomyia fasciata* convoie la fièvre jaune.

Le *Culex fatigans* a été accusé de transmettre des fièvres nommées "dengue" (Beyrouth, Philippines). Nous verrons plus loin qu'une autre fièvre rangée également dans la catégorie dengue est sûrement transmise par des phlébotomes. En Afrique du Sud, d'après Theiler, c'est encore aux moustiques qu'il faudrait penser dans la transmission de la "horse-sickness" (Anopheles et Stegomyia) et de la fièvre catarrhale des moutons (Culex).

Les moustiques ont encore été accusés de jouer un rôle dans la propagation de la lèpre; mais cette opinion ne paraît reposer, à l'heure actuelle, sur aucune base sérieuse. On a aussi pensé à ces insectes pour le bouton d'orient et Wenyon a récemment observé une évolution (ou culture) de la *Leishmania tropica* chez *Stegomyia.*

A côté de la famille des Culicidæ, se trouvent la familles des Simulidæ et les Ceratopogoninæ (sous-famille des Chironomidæ) dont les représentants sucent le sang et sont, les premiers surtout, parmi les insectes les plus désagréables par leurs piqûres. On ne sait pas encore à coup sûr s'ils propagent des maladies microbiennes. Les simulies ont été incriminées dans la propagation de la lèpre; mais les preuves manquent.

En revanche, on est certain, depuis les recherches de la commission autrichienne, que le genre *Phlebotomus,* de la famille des Psychodidæ, répandu non-seulement dans les pays chauds, mais encore dans les régions tempérées, convoie une de ces fièvres à virus filtrant connue sous le nom de dengue.

Les Tabanidæ ont été incriminés dans la propagation de diverses tryponosomiases du type surra, et il semble bien, d'après les constatations épidémiologiques faites aux Indes et en Algérie, et les quelques expériences réalisées, qu'il en est ainsi. En tous cas, il est indiqué dès maintenant d'entamer la lutte contre ces insectes.

Des faits ont été signalés concernant le rôle des taons dans la transmission de l'anémie infectieuse du cheval.

La grande famille des Muscidæ renferme un certain nombre de genres d'insectes piqueurs et suceurs de sang. Les plus importants à considérer sont les stomoxes et les glossines, ou mouches tsétsé.

Les stomoxes, ou mouches à bestiaux, répandus dans toutes les parties du monde, sont capables de convoyer des maladies infectieuses. Ils ont été accusés, en diverses contrées, de propager les trypanosomiases du type surra: à Maurice, à Ceylan, au Soudan. Il est probable qu'aux Indes ils ont leur rôle à côté des tabanides. Ce rôle ne serait pas négligeable même dans les trypanosomiases à tsétsés; ainsi, la souma est propagée dans les troupeaux par les stomoxes et c'est sans doute ainsi qu'elle a pu s'implanter dans des régions, telle que l'Erythrée, où les tsétsés manquent.

Le rôle des stomoxes est à rechercher dans d'autres groupes de maladies. Par exemple, il semble bien, d'après les recherches de Noë, que le *Stomoxys calcitrans* est l'hôte intermédiaire de la *Filaria labiato-papillosa* du bœuf. Les savants américains croient à son rôle dans la propagation de la polyomyélite. Expérimentalement, Scheuberg et Kuhn ont transmis par les piqûres de stomoxes divers virus et en particulier la bactéridie charbonneuse.

Les glossines, presque limitées à l'Afrique intertropicale qu'elles ne débordent qu'au sud-est ont un rôle bien mieux défini. Une des espèces en particulier, la *Glossina palpalis,* propage la maladie du sommeil et diverses trypanosomiases animales: souma, infections à *Tr. dimorphon* et à *Tr. congolense,* maladies du type nagana de l'Afrique orientale.

La *Glossina morsitans* et la *Gl. pallidipes* (qui n'en est guère qu'une variété), les premières connues des tsétsés, tsétsés de brousse, assez xérophiles, convoient le nagana et probablement aussi d'autres trypanosomiases animales. Les recherches récentes ont montré que la *Gl. morsitans* jouait également un rôle dans la transmission de la maladie du sommeil, surtout quand l'agent est *Tr. rhodesiense.*

Glossina longipalpis, qui appartient au même groupe que *Gl. morsitans,* mais qui est plus hygrophile, paraît être l'agent principal de transmission du *Tr. pecaudi* (Baléri), au moins au Dahomey. Au Chari ce rôle serait dévolu à la *Gl. tachinoides.*

D'après R. Koch et Kleine, le trypan. du crocodile évoluerait chez la *Gl. palpalis;* mais ils ne se prononcent pas sur le point de savoir si cette tsétsé est capable d'inoculer l'infection au crocodile.

Il convient de citer ici les mouches ordinaires (*Musca, Calliphora,* etc.). Il n'y a rien à ajouter de nouveau aux faits déjà bien connus relatifs au rôle de ces mouches dans la fièvre typhoide, le choléra, et, en général, les infections intestinales dont les microbes, expulsés avec les excréments, peuvent être transportés par n'importe quelle partie du corps des insectes. Rien de nouveau non plus à dire au sujet de la propagation du charbon et les maladies similaires.

Le rôle des mouches non piqueuses dans l'étiologie du bouton d'Orient, mis en avant par beaucoup d'observateur, reste encore à l'état d'hypothèse.

Les insectes pupipares, les plus dégradés, au point de vue morphologique, des diptères proprement dits suceurs de sang, n'ont pas encore été reconnus comme agents de propagation de graves maladies épizootiques. Mais les hippobosques transmettent l'infection des bovidés à *Trypan. Theileri*, au moins au Transvaal, et il ya lieu de les incriminer pour les autres parties du monde.

Les mélophages (*M. ovinus*) qui renferment normalement dans leur tube digestif un trypanosomide, ont été incriminés, sans preuve décisive jusqu'ici, de convoyer le trypan. récemment découvert chez le mouton.

Les *Ornithomyia* sont peut-être parmi les insectes qui inoculent les trypan. d'oiseaux. Enfin, un fait bien établi est le rôle des *Lynchia* dans la transmission de l'hématozoaire endoglobulaire pigmenté des pigeons connu sous le nom d'*Hæmoproteus* (*Halteridium*) *columbæ.*

Puces.—Ce groupe, isolé dans la classification des insectes, est souvent rapproché des diptères. Le rôle le plus important des puces est celui de convoyer la peste. Les recherches de Gauthier et Raybaud, à Marseille, de la commission anglaise de la peste aux Indes, celles de Werbitzki en Russie, ont établi, sur des bases expérimentales définitives, ce rôle reconnu par Simond dès 1898.

La puce, qui joue le rôle prépondérant, est le *Pulex* (ou *Lœmopsylla*) *cheopis*, qui appartient au groupe des puces sans peignes. Cette puce, qui a pour hôte ordinaire le rat, pique l'homme volontiers. D'autres espèces (*Ctenocephalus serraticeps felis* et *canis, Pulex irritans*) peuvent aussi jouer un certain rôle dans la propagation humaine; enfin, certaines espèces (telles que les *Ceratophyllus*) qui ne piquent guère que les rongeurs, propagent certainement la peste des rats, des spermophiles, etc.

Les puces doivent avoir également un rôle dans la propagation d'autres maladies bactériennes septicémiques.

Les recherches étiologiques concernant le kala-azar méditerranéen, inaugurées par Ch. Nicolle, mettent aussi en cause les puces. La puce du chien (*Ctenocephalus serraticeps canis*) inoculerait la *Leishmania* de chien à chien et de chien à homme (expériences de Basile). Le *Pulex irritans* jouerait un rôle analogue. C'est encore les puces qu'il faut incriminer dans la transmission des trypan. non pathogènes des rongeurs, dont le type est le *Tr. Lewisi* du rat. Le rôle du *Ceratophyllus fasciatus*, mis hors de conteste depuis les travaux de Minchin et Thomson, a donné lieu à des discussions fort intéressantes dont nous retrouverons les résultats plus loin. D'autres espèces, telles que *Ctenocephalus serraticeps*, seraient aussi des agents de transmission.

Hémiptères.—Les hémiptères proprement dites (hémiptères hétéroptères), qui comprennent les punaises et les réduvides, sont certainement des agents de propagation des maladies infectieuses.

Les punaises (genre *Cimex*) ont leur rôle, à côté des puces, dans la propagation de la peste, en particulier d'homme à homme. Accusées depuis longtemps de transmettre la fièvre récurrente (infections à *Spirochæta Obermeieri* ou *recurrentis*), elles ne nous paraissent pas encore, malgré les recherches récentes relatives au rôle des poux, complètement lavées de cette accusation. Accusées récemment par Patton de convoyer le kala-azar indien, et même le bouton d'orient, leur rôle ne nous paraît pas encore établi, bien que Patton ait décrit une évolution en flagellés dans le tube digestif des punaises.

Pour la même leishmaniose indienne, Donovan a incriminé les *Conorhinus* (*C. rubro-fasciatus*); c'est encore une simple hypothèse. Un fait bien demontré est le rôle du *Conorhinus megistus*, au Brésil, dans la transmission de la trypanosomiase humaine, découverte par Chagas. Brumpt a vu que le *Schizotrypanum cruzi* accomplit les mêmes transformations chez d'autres insectes, tels que les punaises, que chez le *Conorhinus*. Ces insectes doivent donc être suspectés.

Il convient aussi de citer les observations de Lafont qui a trouvé chez les *Conorhinus* des îles Maurice et de la Réunion un trypanosomide inoculable à la souris.

Enfin, on connaît une maladie des plantes, la flagellose des Euphorbes, dont l'agent, *Leptomonas davidi* Lafont, est un trypanosomide qui est transmis par des hémiptères (genres *Nysius* et *Dieuches*) de la famille des Lygæidæ.

Anoploures ou poux.—Les poux sont généralement placés à côté des hémiptères. Leur importance vient de s'affirmer par des travaux récents.

Le rôle du *Pediculus vestimenti* (et même du *Ped. capitis*) dans la transmission du typhus exanthématique est établi par les travaux effectués en Tunisie par Ch. Nicolle et ses collaborateurs, et en Amérique par Ricketts et Wilder, Goldberger et Anderson.

Des considérations épidémiologiques ont amené Mackie, dans l'Inde, Ed. Sergent et Foley, en Algérie, à incriminer les poux de corps, dans la transmission des fièvres récurrentes de ces régions. Ce rôle s'affirme par les expériences que viennent de publier Ch. Nicolle, Blaizot et Conseil.

Le genre *Hæmatopinus* (voisin de *Pediculus*) a certainement un rôle, à côté des puces, dans la propagation des trypanosomes des rongeurs.

Acariens.—Dans le groupe des acariens, ce sont surtout les ixodes (fam. Ixodidæ) qui jouent un rôle important, démontré pour les piroplasmoses, depuis les mémorables recherches de Th. Smith et Kilborne.

Le fait le plus remarquable, sur lequel nous reviendrons plus loin, est que, en général, le parasite se transmet héréditairement de tique à tique. Pour les piroplasmoses ce sont les tiques de la sous-famille des Ixodinæ qui sont à considérer. Pour les spirochétoses (ou tréponémoses septicémiques) ce sont les Argasinæ qui sont en cause, sauf pour la spirochétose équine qui, d'après Theiler, est transmise par un *Rhipicephalus.*

Marchoux et Salimbeni ont établi le rôle des *Argas persicus* dans la transmission de la maladie des poules due au *Sp. gallinarum;* Dutton et Todd, puis Koch, le rôle, soupçonné par Cook, des *Ornithodorus moubata* dans la transmission de la fièvre récurrente de l'Afrique tropicale connue sous le nom de "tick fever."

Une maladie américaine, voisine du typhus exanthématique, la "spotted fever" des Montagnes Rocheuses, est aussi regardée comme transmise par des ixodes, du genre *Dermacentor.*

Les tiques sont encore à incriminer dans la transmission des infections à hémogrégarines et à trypanosomes de vertébrés à sangfroid et à vie exclusivement terrestre. C'est une tique, *Rhipicephalus sanguineus,* qui transmet le leucocytozoaire (hémogrégarine) du chien.

En dehors des Ixodidæ, on a encore incriminé quelques acariens; par exemple, les *Trombidium* (ou rougets) dans la propagation d'une fièvre fluviale du Japon; les *Lælaps* dansla transmission de l'hémogrégarine des leucocytes du rat (Miller, aux Etats-Unis); les *Leiognathus* dans la transmission du *Trypan. vespertilionis.*

Nous devons encore signaler le rôle attribué par Borrel aux *Demodex* dans l'étiologie des tumeurs malignes (épithéliomas de la peau) et aussi de la lèpre. Pour les tumeurs, Borrel fait encore intervenir un certain nombre d'helminthes—tænias, nématodes—comme agents d'inoculation.

Crustacés.—L'enchaînement des faits conduit tout naturellement à citer les filarioses parmi les infections transmises par les culicides. Nous devons, pour être complet, noter ici les Cyclops, lesquels, comme on le sait depuis près de 30 ans, servent d'hôte intermédiaire à la filaire de Médine.

Hirudinées.—Nous tenons à donner une place ici aux sangsues, bien que leur rôle dans la transmission des maladies infectieuses de l'homme ou des animaux domestiques ne paraisse qu'accidentel, si vraiment il existe.

Les sangsues jouent le rôle prépondérant dans la propagation des infections sanguines des poissons, ainsi que des reptiles et des batraciens qui passent une partie de leur vie dans l'eau. Il est en particulier démontré que les hirudinées transmettent les infections à trypanosomes et à trypanoplasmes; or certaines d'entre elles produisent des troubles morbides pouvant conduire à la mort; telle est, par exemple, la trypanoplasmose des carpes transmise par les *Piscicol.* L'attention doit donc être attirée sur le rôle des sangsues.

II. REVUE DES MALADIES INFECTIEUSES CONVOYÉES PAR DES INSECTES OU D'AUTRES INVERTÉBRÉS.

Avant d'examiner les rapports entre les microorganismes et les invertébrés qui leur servent d'hôtes, il nous paraît utile de donner une liste des maladies infectieuses convoyées par les invertébrés. Ce sera la seconde partie d'un tableau à double entrée dont le Paragraphe I de ce rapport constitue la première partie. Cette considération nous permettra d'être bref.

Pour les maladies bactériennes, en dehors de la peste, il y a peu à dire. Le rôle des mouches et autres insectes dans le transport du charbon et autres bactériémies, du choléra, de la fièvre typhoïde et autres infections intestinales, est un rôle de transport banal des germes. Pour la lèpre, aucun fait précis ne permet d'incriminer des invertébrés dans sa propagation.

.Pour la peste il n'en est plus ainsi. En raison de circonstances que nous examinerons au Paragraphe III, les puces et, à un degré beaucoup moindre, les punaises, jouent un rôle capital dans la propagation de la peste. Seule la peste pneumonique qui, d'ailleurs, dans les pays chauds ne revêt jamais la forme épidémique, ne paraît pas relever des puces; il y a, dans ce cas, contagion directe.

Les spirochétoses (ou tréponémoses septicémiques) sont transmises par deux catégories d'invertébrés, sinon plus. Les fièvres récurrentes d'Europe, d'Asie et d'Afrique du Nord, paraissent bien être convoyées par les poux (en particulier le *Pediculus vestimenti*); on croit de moins en moins au rôle des punaises. La spirochétose des Argasinæ aviaire est transmise par des acariens du genre *Argas* (Ixodidæ de la sous-famille); la spirochétose humaine de l'Afrique tropicale par des *Ornithodorus*, genre très voisin des *Argas*. La spirochétose équine a pour second hôte un *Ixodinæ* du genre *Rhipicephalus*.

Les trypanosomiases relèvent, par leur transmission, d'invertébrés encore plus variés. Il y a d'abord toute une catégorie de ces maladies, sévissant dans l'Afrique intertropicale, qui sont convoyées par des insectes diptères du genre *Glossina* (vulg., tsétsés). Ce sont la maladie du sommeil, le nagana, la souma, la baléri, les infections à *Tr. dimorphon*, *Tr. congolense*, etc. Nous verrons qu'il y a évolution, plus ou moins longue et compliquée, du trypan. chez les glossines; d'où le rôle enzootique de ces insectes. Mais d'autres insectes, comme les stomoxes, peuvent convoyer, par mode mécanique, les mêmes trypanosomiases; le cas est bien prouvé pour la souma; ils ont un rôle épizootique.

Pour toute une série de trypanosomiases asiatiques et africaines (surra et maladies plus ou moins voisines), on ne connaît pas d'insecte qui serve de second hôte à l'agent pathogène. Celui-ci serait transmis uniquement par le mode mécanique. Les stomoxydes, les tabanides, ont été accusés, à juste titre, de jouer ce rôle.

Pour les trypanosomiases américaines (caderas, desrengadera, murrina), le rôle des insectes semble probable, mais on n'est pas encore fixé. En ce qui concerne les trypan. non pathogènes des rongeurs, des bovidés et des vertébrés à globules rouges nucléés, il y a toujours, semble-t-il, hôte invertébré: poux et surtout puces pour les rongeurs; hippobosques pour les bovidés; (?) autres pupipares et (?) culicides pour les oiseaux; ixodes et sangsues pour les reptiles et les batraciens; sangsues pour les poissons (trypanosomes et trypanoplasmes). Enfin, la schizotrypanosomiase humaine de Chagas est convoyée par un insecte appartenant encore à un autre groupe: le réduvide, *Conorhinus megistus*.

Il convient de faire deux remarques: (1) l'une relative à l'extrême variété des hôtes invertébrés des trypanosomes; (2) l'autre (qui recevra son dévoloppement au Paragraphe III) relative à la diversité des rapports entre les hôtes et les trypan. On a tous les passages entre une évolution qui peut durer plusieurs semaines et un simple transport mécanique.

Dans cette série des trypanosomiases, une maladie échappe au rôle convoyeur des insectes; c'est la dourine ou maladie du coït. Elle tient la même place dans cette série que la syphilis dans la série des spirochétoses ou tréponémoses. Dans la syphilis comm dans la dourine, la maladie a perdu en grande partie son caractère septicémique.

Les *Leishmania* font le passage entre les trypanosomes et les hématozoaires endoglobulaires. Toutes les leishmanioses sont certainement transmises par des insectes, mais on est loin d'être fixé à cet égard. Á notre avis, le fait le mieux établi est le rôle des puces dans la transmission de la leishmaniose dans le bassin méditerranéen. L'identité de la leishmaniose humaine et de la leishmaniose canine, le passage du virus de chien à chien et du chien à l'homme par le moyen des puces, nous paraissent résulter des travaux publiés à ce jour.

En revanche, nous ne sommes pas convaincu du rôle des punaises dans la transmission de la leishmaniose indienne et encore moins de la leishmaniose cutanée. Les *Leishmania* se cultivent trop facilement sur milieux au sang pour qu'il n'y ait pas lieu de songer à cette cause d'erreur dans les expériences de Patton. Wenyon a d'ailleurs vu des flagellés apparaître dans le tube digestif, non seulement des *Cimex*, mais encore des *Stegomyia*, ayant sucé de la sérosité riche en *L. tropica*.

Pour la leishmaniose indienne, on a encore accusé les *Conorhinus;* pour le bouton d'orient, les moustiques, les phlébotomes, les mouches ordinaires.

Les piroplasmoses sont parmi les maladies à protozoaires pour lesquelles le rôle des invertébrés est le plus ancien et le mieux connu. Dans ce cas, c'est un groupe limité et défini d'invertébrés (acariens de la sous-famille Ixodinæ) qui remplissent le rôle de seconds hôtes.

Pour les piroplasmoses proprement dites, dont le type est la piroplasmose bovine produite par *Pir. bigeminum,* le parasite passe de la tique-mère à la tique-fille par l'œuf; il peut ainsi se conserver pendant plusieurs générations sans repasser par le vertébré. Nous reviendrons sur ce point au Paragraphe III. Chez les theilérioses, dont le type est la fièvre de la côte orientale d'Afrique (East coast fever), ce passage héréditaire manque.

Nous arrivons au paludisme et autres infections produites par les *Plasmodium.* Comme nous l'avons déjà dit au Paragraphe I, il n'y a rien à ajouter aux recherches de Ross et de ses émules, établissant le rôle des moustiques. Pour le genre *Hæmoproteus,* autre type d'hématozoaire pigmenté, un seul fait est définitivement établi; c'est le rôle d'un insecte pupipare, *Lynchia maura,* dans la transmission d'*Hæmoproteus columbæ.*

Pour les hémogrégarines, il semble exister la même variété d'hôtes invertébrés que pour les trypanosomes non pathogènes: tique *Rhipicephalus sanguineus* pour le leucocytozoaire du chien; acarien d'une autre famille (*Lœlaps echidninus*) pour le leucocytozoaire du rat; tiques ou sangsues pour les hémogrégarines des vertébrés à sang froid.

Si, par une courte incursion dans le domaine des infections à métazoaires, nous examinons la transmission des filarioses, nous constaterons encore une grande variété d'hôtes invertébrés: culicides pour la *Filaria Bancrofti* et la *Fil. immitis;* crustacés copépodes pour la filaire de Médine; (?) à la fois Ixode (*Rhipicephalus siculus*) et puce (*Ctenoc. serraticeps*) par le *Fil. recondita;* pou de la sous-famille des Leiothinæ pour la *Fil. cypseli* d'un martinet; sans compter ceux qui restent à découvrir, en particulier pour les autres filaires humaines.

On retrouve donc partout, sauf pour les piroplasmoses, cette variété d'hôtes invertébrés. Le hasard de leur parasitisme, ou de leurs habitudes de vie, sur un vertébré, semble avoir conditionné, à peu près à lui seul, leur rôle de transmetteurs. Il y a là, à notre sens, un argument important contre la thèse, qui se présente a priori à l'esprit, que l'invertébré est l'hôte primitif pour les divers hématozoaires: trypanosomes, hémogrégarines, plasmodiums.

Il nous reste à examiner une dernière grande catégorie de maladies qui sont convoyées par des invertébrés. Ce sont les infections sanguines à germes dits "ultramicroscopiques," qui traversent les filtres, imperméables pour les microbes ordinaires.

Il faut citer en première ligne la fièvre jaune. Ce sera l'impérissable honneur de la commission américaine de Cuba d'avoir établi le rôle d'un moustique, le *Stegomyia fasciata*, dans cette transmission.

Une forme de dengue relèverait aussi des moustiques (en particulier *Culex fatigans*) d'après les expériences de Ashburn et Craig aux Philippines. Dans le bassin de la Méditerranée, la maladie cataloguée dengue est sûrement transmise par un insecte d'une famille voisine des culicides, le *Phlebotomus papatasii*.

Theiler, qui connait si bien les maladies du bétail dans l'Afrique du Sud, est persuadé que plusieurs des maladies à germes invisibles sont transmises par des insectes: la horse-sickness et la fièvre catarrhale des moutons relèveraient de moustiques, *Anopheles* et *Stegomyia* dans le premier cas, *Culex* dans le second; la heart water des ruminants serait convoyée par une tique, *Amblyomma hæbreum*.

Une des acquisitions les plus importantes de ces dernières années est la démonstration du rôle des poux dans la transmission du typhus exanthématique. La maladie apparentée, connue aux États-Unis sous le nom de "spotted fever" des Montagnes Rocheuses, est propagée par l'ixode *Dermacentor*. La fièvre fluviale du Japon serait transmise par des *Trombidium*. Nouvel exemple de variations de l'hôte invertébré dans un groupe assez étroit d'infections du vertébré.

III. RAPPORT DES INVERTÉBRÉS ET DES MICROORGANISMES QU'ILS CONVOIENT.

Transport mécanique.—Nous avons vu que les insectes non piqueurs et suceurs de sang jouent un rôle infime à côté des insectes piqueurs. Dans tous les cas où ce rôle a été reconnu et que nous avons cités, l'insecte en question—généralement des mouches du type de la mouche domestique—transporte avec l'extrémité de sa trompe, ou de ses pattes, ou des autres points saillants de son corps, ou dans son tube digestif, le matériel contaminé (ex.: excréments typhiques ou cholériques) et va en souiller les surfaces sur lesquelles il se pose ensuite.

Il y a là un simple rôle mécanique. Il peut en être de même avec les insectes piqueurs. L'insecte, en suçant le sang, souille sa trompe avec le virus qu'il inocule ensuite à un autre animal (ou homme) en le piquant. Dans ces cas, la trompe de l'insecte joue le rôle d'une aiguille de seringue qui serait plongée alternativement dans le milieu virulent et dans un individu sensible. Naturellement, plus l'intervalle augmente entre les deux piqûres, plus les chances de contagion diminuent; dans un certain nombre de cas, on n'obtient des résultats positifs que quand les deux piqûres se succèdent immédiatement, l'insecte commençant son repas de sang sur le premier individu et le finissant sur le second.

Les invertébrés, qui transportent ainsi les virus, ne doivent avoir à priori rien de spécifique; ils ne sont à aucun degré des hôtes pour le parasite. On observe pourtant des particularités qui impliquent une certaine spécificité. Ainsi telle espèce d'insectes sera plus apte à transporter un virus qu'une autre; d'après Ed. et Et. Sergent, les tabanides convoient mieux le trypanosome du debab algérien que les stomoxydes; d'après Minchin, pour ce qui concerne le trypan. du nagana, les tsétsés ont un rôle mécanique supérieur à celui des stomoxes; d'après Bouffard, les stomoxes ont un rôle de choix dans le transport épizootique de certaines trypanosomiases à tsétsés telles que la souma. Dans certains cas, encore incomplètement connus, l'intervalle entre les deux piqûres peut atteindre 1, 2 et même 3 jours: expériences récentes de Bouet et Roubaud pour le transport du *Tr. soudanense* par les stomoxes. L'explication de toutes ces particularités n'est pas encore satisfaisante et requiert de nouvelles expériences.

L'invertébré second hôte.—Arrivons maintenant aux cas plus complexes, où il y a évolution ou au moins multiplication du parasite chez l'invertébré. Le cas le plus simple de cette série est celui où il y a simple multiplication, sans transformation ou modification, dans le tube digestif de l'insecte. Par exemple. le cocco—bacille pesteux se multiplie, pendant plusieurs jours, dans le tube digestif de la puce ou de la punaise. Il y a donc là un simple mode de conservation du virus et l'insecte ne peut pas encore être regardé comme un second hôte.

Mais dans le plus grand nombre des cas, il y a, comme nous l'avons déjà dit, évolution cyclique. Le parasite part naturellement de sa forme sanguine, telle qu'elle est ingérée par l'invertébré, passe par une série plus ou moins compliquée de stades sous lesquels il ne serait pas inoculable au vertébré, puis revient à des formes qui, généralement en raison de leur morphologie, sont infectantes. On traduit cette évolution par la formule: il y a incubation chez l'invertébré. Dans un certain nombre de cas, comme ceux des microbes dits invisibles, on ne peut noter que cette incubation. Il convient de faire remarquer que cette notion d'incubation n'est pas simple; elle implique à la fois l'idée d'un retour à la forme inoculable, la seule notion dont nous nous occupions en ce moment, et l'idée que cette forme inoculable se trouve mise dans des conditions qui lui permettent de pénétrer chez le vertébré.

Un cas très simple, sans doute le plus simple, d'évolution cyclique est celui du *Trypan. Cazalboui*; cette évolution est limitée à la trompe des tsétsés (Bouffard, Roubaud). Le liquide salivaire, toujours abondant chez les glossines, suffit à cette évolution. Les changements morphologiques sont très simples; le trypanosome devient trapu, se fixe par son flagelle au labre ou à l'hypopharynx; le centrosome vient au voisinage du noyau. L'animalcule se multiplie sous cette forme. Puis, au bout de quelques jours, il revient au type trypanosome et bientôt est réinoculable. L'évolution dure une semaine environ; mais l'insecte reste jusqu'à la fin de sa vie infectant.

Pour la plupart des autres trypanosomes pathogènes, transmis par les tsétsés, l'évolution est plus compliquée. Il y a multiplication dans le tube digestif proprement dit sous forme *Crithidia* et le retour à la trompe se fait plus tardivement. L'incubation atteint quelques semaines.

Ici les auteurs ne sont pas d'accord sur le mode de retour à la trompe. Pour Roubaud qui, avec Bouet, a étudié l'évolution des *Tr. dimorphon* et *Pecaudi*, il y a simple retour à la trompe de parasites intestinaux et on arrive indirectement au résultat obtenu directement dans le cas du *Tr. Cazalboui*. Pour Sir David Bruce et ses collaborateurs qui ont surtout étudié le *Tr. gambiense*, le retour se ferait par la voie des glandes salivaires. Chagas, en ce qui concerne *Schizotrypanum Cruzi* chez *Conorhinus megistus*, aurait observé ce passage. Mais il ne faut pas oublier que le trypan. en question évolue chez un hémiptère et que, chez ces insectes, l'invasion de la cavité du corps par les parasites est plus commune que chez les diptères. Brumpt n'a pas confirmé cette partie des observations de Chagas.

Pour ce qui concerne les trypan. d'oiseaux chez les moustiques, les trypan. de vertébrés à sang-froid chez les sangsues, les trypan. se retrouvent finalement dans le tissu autour de la base de la trompe.

Le type d'évolution le plus complet paraît être celui des *Plasmodium*. L'évolution débute, dans l'estomac du moustique, par un phénomène sexuel: fécondation d'un macrogamète arrondi par un microgamète filiforme. L'œuf offre cette particularité de se transformer en un vermicule mobile (ookinète) qui traverse les parois du tube digestif et se met en boule à la surface externe de ces parois. La boule grossit peu à peu en s'entourant d'une membrane assez résistante. En même temps se développent à son intérieur des éléments allongés, des sporozoïtes. Ces sporozoïtes, en liberté dans la cavité du corps, gagnent les glandes salivaires et arrivent finalement dans le conduit de la trompe.

Lés hémogrégarines subissent, chez les sangsues ou les tiques, une évolution assez semblable à celle des *Plasmodium*, qui débute également par un phénomène sexuel et qui aboutit à la constitution de kystes dans lesquels se forment des sporozoïtes, qui sont les éléments d'infection du vertébré.

Les piroplasmes présentent, chez les tiques, une évolution également compliquée, connue surtout par le travail de Christophers qui a suivi le sort du *Pir. canis* chez *Rhipicephalus sanguineus*. Les sporozoïtes sont, en dernier lieu, dans les cellules des glandes salivaires ou dans les cellules embryonnaires.

Le cas des spirochètes ne paraît pas encore définitivement élucidé. Il est certain que les parasites passent rapidement dans la cavité du corps des tiques ou des poux. D'après Leishman, Hindle, on trouve dans les tissus des granules qui résultent d'une sorte d'émiettement de l'organisme filiforme, qu'ils sont capables de reproduire. Marchoux et Couvy, puis Nicolle, Blaizot et Conseil, ont signalé des spirochètes très fins, à la limite de la visibilité, qui reprendraient ensuite, peu à peu, le calibre normal, sous lequel ils sont infectants pour le vertébré.

Dans le cas des hématozoaires endoglobulaires tout au moins, il y a, au début de l'évolution chez l'invertébré, phénomène sexuel hétérogamique. Si donc nous adoptons la nomenclature généralement usitée des zoologistes, nous dirons que, dans ces cas, l'invertébré est l'hôte définitif, le vertébré l'hôte intermédiaire.

Pour ce qui concerne les trypanosomes, on a décrit, par exemple pour le *Tr. Lewisi*, des phénomènes sexuels hétérogamiques. Mais le fait mérite confirmation, et dans les cas au moins des trypan. pathogènes, aucun acte sexuel hétérogamique n'a été signalé. On est encore moins avancé en ce qui concerne les spirochètes.

On doit à Gonder la découverte d'un phénomène fort intéressant; il a vu que les races de trypan. résistantes aux médicaments, qui peuvent subsister un temps indéfini par passages de vertébré, perdent leur caractère en passant par l'invertébré (race de *Tr. Lewisi* résistante à l'arsénophénylglyrine et *Hæmatopinus spinulosus*); ce serait, à partir du phénomène sexuel, que le retour au type primitif aurait lieu.

Dans le cas des filaires, c'est le vertébré qui est l'hôte définitif et l'invertébré l'hôte intermédiaire. Pour la *F. Bancrofti*, l'évolution a lieu dans l'hôte intermédiaire; pour la *F. immitis*, dans les tubes de Malpighi. Il y a passage, par croissance et mues successives, de la forme embryonnaire à une forme ayant les caractères morphologiques de l'adulte.

Dans le cas des virus invisibles, on ne peut suivre au microscope les transformations des microbes; mais les expériences faites pour reconnaître à quel moment l'insecte devient infectant permettent d'établir qu'il y a encore évolution cyclique dans ces cas. L'exemple du *Stegomyia fasciata* et du virus amaril est particulièrement net à cet égard; on sait que les Stegomyia qui ont sucé du sang de jauneux ne sont capables d'inoculer la fièvre jaune que 12 jours au moins après. Des résultats de même ordre ont été observés dans le cas de la dengue.

Passage de l'invertébré au vertébré.—Une dernière question, dont il est inutile de souligner l'importance, que nous devons traiter est la suivante: Comment le microbe est-il réinoculé au vertébré? Cette question présente un intérêt d'actualité.

Le microbe est pris dans le sang et on peut considérer que, en règle, la meilleure mode de réinoculation est de replacer ce microbe dans le système circulatoire. L'insecte qui l'a pris, dans le corps duquel il a évolue, devrait donc pouvoir le réinoculer par sa trompe. C'est le cas classique de l'hématozoaire de Laveran; c'est même le cas le plus répandu; ce n'est pas le seul. Nous allons l'examiner d'abord.

Chez l'invertébré, le développement commence toujours dans le tube digestif, s'y effectue parfois en entier; d'autres fois l'évolution se continue dans la cavité du corps. Plusieurs modes permettent au germe de se retrouver dans la trompe quand son évolution est terminée.

Le cas du *Tr. Cazalboui*, déjà cité, où toute l'évolution s'effectue dans la trompe, est évidemment le plus simple. Le cas des autres trypan. pathogènes (*Pecaudi*, *dimorphon*, etc.) est un peu plus compliqué, surtout si, comme l'affirment Bruce et ses collaborateurs pour *Tr. gambiense*, le trypan. passe par la cavité du corps, puis par les glandes salivaires. Chagas dit avoir surpris ce voyage dans le cas du *Schizotrypanum Cruzi*.

Dans le cas des moustiques (Schaudinn), des sangsues (Brumpt), les trypan. se réunissent à la base de la trompe, dans la région environnante, et pénètrent dans la trompe, au moment de la piqûre, à la faveur d'une effraction. Ce serait par une processus analogue que les hémogrégarines de la tortue de marais, après avoir évolué chez la sangsue *Placobdella catenigera*, pénètreraient dans le conduit de la trompe (Reichenow).

Le cas le plus compliqué est celui des *Plasmodium*. Nous avons vu la longue évolution qui s'accomplit chez le moustique. Sans aucune effraction, les sporozoïtes, germes d'inoculation, arrivent, par la voie des glandes salivaires, dans le canal de la trompe. C'est certainement le cas le plus remarquable d'adaptation.

Il y a également passage par les glandes salivaires pour les piroplasmes. On ne peut savoir quelle voie suit le virus invisible de la fièvre jaune chez le *Stegomyia*, de la dengue chez le *Phlebotoms*, du typhus exanthématique chez les *Pediculus*. Ce qui est certain, c'est qu'ils sont inoculés par la trompe de l'insecte. Le cas des spirochètes est discuté et nous y reviendrons plus loin.

Quand le virus ne revient pas, ou ne revient qu'accidentellement, pour ainsi dire, dans la cavité de la trompe, d'autres modes d'inoculation s'observentdont nous allons parler maintenant.

Nous citerons d'abord le cas des filaires inoculées par les moustiques, car il constitue une sorte de mode intermédiaire.

Lorsque l'évolution chez le moustique est terminée, les jeunes nématodes se meuvent dans le corps de l'insecte et viennent généralement s'accumuler dans la lèvre inférieure. Mais cette lèvre ne fait pas partie de la trompe proprement dite qui pénètre dans le corps de l'animal piqué. Seulement elle se recourbe au moment de la piqûre et les jeunes filaires, comprimées, vont buter, à l'extrémité de la lèvre, en un point de moindre résistance, qui cède à leur pression. Elles peuvent ainsi s'échapper et elles se trouvent amenées à la surface de la peau, puisque cette région mince (membrane de Dutton) est au point de jonction des deux labelles qui se sont écartés pour s'appliquer sur la peau. Les jeunes filaires pénètrent activement à l'intérieur du corps, en traversant la surface cutanée. Étant donne leur constitution, elles sont même capables de pénétrer à travers une peau parfaitement saine.

Dans un certain nombre de cas de transmission par les insectes, le virus est simplement déposé à la surface de la peau qu'il doit traverser; en général, et au contraire des filaires, il ne paraît pouvoir le faire qu'à la faveur d'une excoriation, d'une solution de continuité telle que celle que produit la piqûre de l'insecte.

Par exemple, pour le microbe pesteux, on a abandonné l'idée qu'il y avait inoculation par la trompe de l'insecte, dans laquelle le bacille manque ainsi que dans les glandes salivaires. Il semble bien que les choses se passent comme Simond et Zirolia l'avaient supposé dès les premières constatations. Le microbe expulsé avec les excréments de la puce ou de la punaise sur la peau de l'homme ou de l'animal réceptif, s'y trouve par hasard au contact d'une partie excoriée et pénètre par cette porte d'entrée.

Pour le *Schizotrypanum Cruzi,* Brumpt est tenté de croire que l'infection, par pénétration cutanée des trypan. expulsés avec les excréments, est un mode plus général que l'inoculation par la trompe.

Dans le cas des spirochétoses, Leishman et Hindle croient que le spirochète est transmis par infection de la piqûre avec le liquide coxal et les excréments des Argas; mais il convient de remarquer que Marchoux et Couvy ont obtenu des infections par piqûre non accompagnée d'émission de liquide coxal.

Si ce sont les microbes émis avec les excréments qui servent en général d'agents d'infection, cela tient surtout à ce qu'ils se trouvent amenés à la surface de la peau. Mais les microbes enfermés dans le tube digestif peuvent posséder les mêmes propriétés infectantes. Pour la peste, il est prouvé que l'infection est réalisée plus facilement quand les puces ou les punaises sont écrasées à la surface du corps. Pour la spirochétose humaine transmise par les poux, les microbes, mis en liberté par écrasement de l'insecte, traversent les parties excoriées qui peuvent être produites par grattage avec des ongles imprégnés de matière virulente (Ch. Nicolle, Blaizot et Conseil).

Pour d'autres microbes, même transmis normalement par piqûres d'insectes, l'écrasement de l'insecte infectant à la surface de la peau du vertébré peut déterminer une infection: Stomoxes trypanosomés; moustiques renfermant dans leurs glandes salivaires, des sporozoïtes du plasmodium des oiseaux.

Dans une troisième catégorie de cas, l'infection peut se faire par la voie digestive. Si ce mode d'infection n'a pas l'importance qu'on lui attribuait autrefois, il n'est néanmoins pas négligeable.

Nous citerons d'abord le cas du *Trypan. Lewisi* évoluant chez la puce du rat, *Ceratophyllus fasciatus.* Jamais on ne trouve de parasites dans les glandes salivaires. Le parasite serait incapable de remonter, de l'intestin postérieur de la puce, à la trompe. Par simple piqûre, par exemple à travers une gaze, on n'obtient généralement que des infections relevant du mode mécanique. D'après Strickland, en règle, le rat s'infecterait en mangeant les puces infectées. D'après Nöller (qui a expérimenté avec *Ctenocephalus serraticeps*), l'infection se ferait par le'chage de la peau sur laquelle les puces ont déposé leurs excréments contenant des trypanosomes. Si, comme le pensent Minchin et Thomson, il peut aussi y avoir inoculation par simple piqûre, on se trouverait en présence d'une sorte d'indétermination dans le mode d'infection. Le mode signalé par Nöller est intermédiaire entre la seconde et la troisième catégorie.

Dans le domaine des hématozoaires endoglobulaires, nous pouvons citer le cas du leucocytozoaire du rat, si bien étudié par le regretté Miller. Il y a, chez le *Laelaps*, une évolution, calquée dans ses grandes lignes, sur celle des *Plasmodium*; mais on ne trouve pas de sporozoïtes mobiles dans les glandes salivaires. L'acarien ne paraît pas capable d'inoculer le parasite par piqûre. Les expériences de Miller ont établi que le rat s'infecte en ingérant des *Laelaps* parasités. Tel est aussi le mode d'infection dans le cas de la filaire de Médine. Le parasite, qui a évolué dans le corps du Cyclops, est mis en liberté au contact d'une solution faible de HCl (analogue à la concentration du suc gastrique) qui tue le crustacé (expériences de Leiper).

En assemblant et rapprochant tous ces faits, on voit donc que le parasite, pris au vertébré avec son sang par l'invertébré qui le pique, est réinoculé de façons très variées qui peuvent se classer en 3 catégories: (1) Il y a réinoculation dans le sang au moment d'une nouvelle piqûre (façon purement passive de la part du parasite); (2) il y a ingestion de l'invertébré dont les parasites sont ainsi mis en liberté dans le tube digestif du vertébré; (3) il y a dépôt des parasites à la surface du corps du vertébré. C'est ce mode qui présente le plus de variations depuis le cas de la peste où les microbes sont mis en liberté avec les excréments jusqu'au cas des filaires où un mécanisme spécial entre en jeu, en passant par le cas de la spirochétose et du pou, tel que l'ont fait connaître Nicolle et ses collaborateurs.

Transmission héréditaire chez l'invertébré.—Nous avons déjà fait allusion au cas des piroplasmes chez les tiques. Les sporozoïtes, qui prennent naissance chez la tique, sont capables d'aller parasiter les cellules ovulaires et on les retrouve dans les œufs; les tiques-filles qui en dérivent sont parasitées et sont capables d'inoculer l'infection. Le parasite peut ainsi se conserver pendant plusieurs générations d'invertébrés. Theiler a vu des tiques petites-filles capables de convoyer la piroplasmose bovine (tiques mères infectées ayant vécu sur bœuf, tiques filles sur cheval, non sensible). Möllers a observé des faits semblables avec des *Ornithodorus* qui convoient le *Spirochæta Duttoni.*

C'est grâce à cette conservation héréditaire que des tiques, telles que *Boophilus annulatus* ou *B. decoloratus,* peuvent propager la piroplasmose bovine. En effet, ces tiques passent toute leur vie sur le même hôte. Mais la transmission héréditaire existe aussi dans le cas de tiques qui, comme *Rhipicephalus sanguineus* ou *Hæmaphysalis Leachi* (les transmetteurs de la piroplasmose canine), abandonnent leurs hôtes en passant du stade larvaire au stade nymphal, et aussi du stade nymphal au stade adulte, ou encore dans le cas de tiques qui comme les Argasinæ (les transmetteurs des spirochétoses) ne sont pas attachés à leurs hôtes. D'après Ch. Nicolle et ses collaborateurs, il y aurait aussi passage héréditaire du spirochète chez le pou. Seulement, dans tous ces cas, les tiques mères sont capables, aussi bien que les tiques filles, de transmettre l'infection.

En l'état actuel de nos connaissances, ce passage par l'œuf de l'invertébré (en général ixode) est presque limité aux piroplasmes et aux spirochètes. Il paraît bien prouvé qu'il n'existe pas pour les trypanosomes pathogènes transmis par les tsétsés; mais Brumpt en a signalé un exemple avec le *Tr. inopinatum* de la grenouille verte transmis par une sangsue.

Nous espérons avoir passé en revue toutes les relations possibles entre les invertébrés et les microbes qu'ils transmettent, avec la préoccupation de mettre en relief les faits nouvellement acquis.

DISCUSSION.

Dr. L. O. HOWARD: Dr. Howard referred chiefly to the remarks concerning the relatively slight importance of the house fly in the carriage of typhoid fever in well-sanitated cities, or rather to the argument that the relative value of the different methods of carriage of typhoid fever under such conditions must be studied from a mathematical standpoint. Dr. Howard called attention to the discussion which

had taken place during the morning session on the subject of chronic carriers of disease, and he pointed out that it had been well established that a definite percentage (3 to 4) of all persons who have suffered from typhoid fever become chronic carriers of the disease after convalesence and for a period of time which may last for many years. Here is a definite mathematical percentage based upon observations of investigators in Germany and elsewhere. He pointed out that Washington has the reputation of being a well-cared-for city from a sanitary point of view, but he showed that each year for the last 10 years there have been some hundreds or perhaps thousands of cases of typhoid fever in this city. It is obvious, therefore, that in Washington there are hundreds of unknown and undiscovered chronic carriers of typhoid. He further showed that even in such a well-conducted city as Washington there are still many uncared-for box privies. He stated that, from his own observation, the deposition of feces overnight in the summer time in uncared-for waste lots, and in the back alleyways in the lower parts of the city, is very common. He remarked that the children of the indigent in these lower parts of the city are in the habit of easing themselves wherever they chance to be, and always in the presence of swarms of flies, and in proximity to unscreened kitchens and unscreened food supplies. Therefore, with the certainty that there are a large number of undiscovered carriers in the population, does it require a mathematical demonstration to prove that a certain percentage of this carelessly dropped excrement has been left by chronic carriers, and that a certain percentage of it contains virulent typhoid germs? How is it possible, therefore, to say that the house fly is not an important factor in the carriage of typhoid fever, even in the average of the best American cities?

Prof. G. H. F. Nuttall: It should be remembered that a fly may cause relatively gross infection of any food upon which it alights after having fed upon infective substances, be they typhoid, cholera, or diarrhea stools. Not only is its exterior contaminated, but its intestine is charged with infective material in concentrated form, which may be discharged undigested upon fresh food which it seeks. Consequently the excrement voided by a single fly may contain a greater quantity of the infective agents than, for instance, a sample of infected water. In potential possibilities the droppings of one fly may, in certain circumstances, weigh in the balance as against buckets of water or of milk.

RELATION OF OYSTERS TO THE TRANSMISSION OF INFECTIOUS DISEASES.

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In view of the fact that a paper by Prof. F. P. Gorham, on "The sanitary aspects of the production, storage, and distribution of food fish and shellfish," will be presented before Section VI of this congress, it will be unnecessary to discuss here, in detail, certain fundamental results of scientific investigations concerning the transmission of infectious diseases by the consumption of raw oysters and other shellfish.

It will be assumed that Prof. Gorham will discuss the available evidence tending toward the demonstration:

First, that the consumption of raw oysters and other shellfish, which have been taken from polluted waters, have been the cause of small and large outbreaks of acute gastrointestinal disturbances, and of typhoid fever.

Second, that these outbreaks have always followed the use of polluted shellfish which have been subjected to some floating or drinking process, subsequent to their removal from the beds upon which they have matured and prior to their distribution in retail markets.

Third, that oysters undergo a period of hibernation as the result, in large part, at least, of the lowering of the temperature of the water in which they mature or may be placed, and that during such hibernation the oyster rapidly frees itself from all or nearly all sewage organisms which may have previously gained entrance to its body cavity; and likewise excludes all possibility of entrance of additional sewage organisms. This exclusion is due to a continuous and complete closure of the shells of the oyster.

Fourth, that no outbreaks of infectious diseases have been traced to oysters which have probably been in this recently discovered hibernating condition, but that such outbreaks as have occurred have taken place during months of the year when oysters would not be likely to have been in a hibernating condition.

In other words, it can be assumed as capable of demonstration that outbreaks of acute gastrointestinal disturbances and of typhoid fever have been shown to be due to the consumption of raw oysters and clams which have been floated in specifically polluted waters during a nonhibernating season of the year for these shellfish, but that no evidence exists that oysters taken from their natural or final maturing beds during any season of the year, nor that any oysters—floated or not—during their hibernating period, have ever caused outbreaks or endemic conditions of any infectious disease.

In the majority of outbreaks, the evidence has been conclusive that prior to the development of the symptoms of typhoid fever, after the proper period of incubation, there had occurred gastrointestinal disturbances in some of those developing typhoid fever and also in others who had consumed the shellfish, but did not develop typhoid. These acute gastrointestinal disturbances were indicative of infection with bacteria of the dysentery bacillus group. Their development as a result of the consumption of polluted shellfish is comparable to the occurrence of similar disturbances following instances of the use of polluted water, milk, and so forth, which have resulted in outbreaks of typhoid fever.

No evidence exists of the transmission by oysters of other infectious diseases than those already mentioned. However, as it can be properly assumed that human sewage frequently contains tubercle bacilli of the human type, the possibility that such organisms could gain entrance to the body cavities of oysters floated in polluted waters during nonhibernating periods undoubtedly exists, although it may be considered rather improbable that such bacteria could gain entrance to oysters or other shellfish in sufficient numbers to be capable of producing an infection in the human being through the consumption of this food in the raw state.

Attempts to elucidate any possible relationship between the consumption of raw shellfish in a nonhibernating period with reported cases of typhoid fever, or of acute gastrointestinal disturbances, present a number of administrative difficulties, if complete demonstration is looked for. It is but rarely possible to trace oysters from their original grower or distributer through the hands of numerous middlemen to their point of final consumption. In the large majority of cases, where studies have been made demonstrating such a relationship, the oysters shown to have had a causal connection with the outbreak have been consumed at one time by considerable numbers of people. Under such circumstances, it has been possible to obtain accurate information concerning the various other types of foods which have been consumed at the same time that the oysters were eaten, and it has been possible to eliminate these other foods as having any etiologic relation with the outbreak.

The retail distribution of oysters is, however, to a large extent among a considerable number of independent if not scattered households or consumers, and records are rarely available as to the final points of such distribution. In these cases it is usually incapable of demonstration that other possible or probable sources of infection have not played the causal rôle. A complete demonstration of the relation of the consumption of raw shellfish to the transmission of infectious diseases would be possible only in those communities where detailed and thorough investigations are systematically made into the probable cause of each individual case of gastrointestinal disturbance or of typhoid fever reported to the official health department. As such thorough epidemiological studies are made in but exceedingly few communities, it is obvious that our information concerning the relation of oysters and shellfish to the transmission of infectious diseases is incomplete. It may be possible that shellfish play a larger part in the transmission of these diseases than has previously been supposed; on the other hand, it is equally true, and more nearly correct, to assume that shellfish do not play as large a rôle in the transmission of infectious diseases as has been supposed by a large number of competent health officials.

In view of the defects in administrative systems just mentioned, it is desirable to consider the requirements for official action looking toward the obtaining of adequate data upon which decisions as to the rôle of oysters as the cause of any particular outbreak or increase in incidents of infectious diseases can be based.

It is obvious that prompt and complete reports of all cases of typhoid fever must be made to the health department by those having professional medical care of such cases. The information given in such reports, as regards the possible causes of infection, should be corroborated by official inquiries made by competent trained epidemiologists. If raw oysters have been consumed within a period of one month prior to the onset of the disease, the epidemiologist should make efforts to obtain the name and address of the retail dealer supplying the oysters in question, and, through him, the name and address of the middleman and of the original grower of the stock.

It is necessary to say that a similar course should be followed for every other article of food consumed during the same period of time, and which might reasonably be suspected of having caused the infection.

It would not be desirable to arrive at any final conclusion concerning the causation of any number of cases of typhoid fever as due to oysters, unless the official health department has a reasonably complete history of the path of the oysters from the maturing grounds to the consumer, and unless such history contains data warranting a more or less conclusive opinion that the oysters were specifically infected at some time during their production or transportation.

It is obvious that the official health departments can obtain such adequate histories of the oysters consumed in any particular instance only by exercising their right of systematic supervision of all or such branches of the industry as are not otherwise under official supervision and at all or at least the important periods of the year.

Before discussing the details of the methods of municipal supervision of the industry it would be well to discuss what parts the Federal and State authorities can constitutionally or advisedly take in the control or supervision of the various aspects of the shellfish business.

It appears to be conclusive in the minds of a large number of most competent students of the Federal Constitution that the Congress of the United States has not the potential right to grant power to any administrative branch of the Federal service to supervise or control the pollution of even navigable tidal waters or interstate rivers and streams other than to prevent injury to navigation. As the pollution of any stream to the point of injury to navigation would render such a stream or body of water obviously unsuited for the cultivation of shellfish, the assumption would appear to be warranted that, so far as the control of the types of pollution of tidal or other bodies of water which might menace oyster maturing grounds or drinking grounds is concerned, the Federal Government is, for the near future, at least, entirely without jurisdiction.

It is true that the Congress of the United States would doubtless be well within its rights if it desired to authorize an administrative department of the Federal Government to investigate the extent of pollution of waters in which oysters are grown or are subjected to the floating process. Such an investigation might well be conducted by the United States Public Health Service. The results of these investigations could, of course, be made public, and would be of very great value and assistance to state and municipal officials in their efforts to supervise the sanitary aspects of the oyster industry. An investigation of this kind, however, requires large appropriations, and a number of years would doubtless elapse before even a majority of the regions occupied by oyster beds could be satisfactorily studied. It is questionable whether more rapid progress would not be made through investigations conducted by the various States in which oyster grounds are located, supplemented by the work of various municipalities.

While it is true that no Federal administrative department has power of supervision over the pollution of tidal or other waters, it is, on the other hand, appropriate to state that the Federal Government has granted to the Department of Agriculture the right of supervision of interstate commerce in food products through the food and drugs acts, especially that of 1906. Provisions are made in these acts whereby a modified and restricted form of police power is exercised by the Department of Agriculture over the shellfish which enter interstate commerce. The Bureau of Chemistry of this department has the authority to investigate the sanitary condition of oysters which have entered interstate commerce, and, indirectly, to investigate the conditions prior to such entry. During the past four years, it has actively carried on this work. However, as the object of these investigations has been and is to obtain information which can be utilized by it in the exercise of this modified form of police power, the data obtained by it are not available for use by State and municipal departments in their investigations, nor can the results be communicated to those whose acts are or have been the subject of inquiry.

The chief results of the work of the Bureau of Chemistry of the Department of Agriculture under the food law have been to stimulate the State and local authorities to institute studies looking toward the creation, by scientific workers, of proper and adequate standard methods of sanitary inspections of oyster grounds and their environment, and of bacteriological examinations of the oysters, and to conduct both types of investigations of oyster grounds and of oysters in their respective localities.

The question has arisen as to the possibility of the Federal Government creating an inspection department for oysters and shellfish comparable to that established under the Bureau of Animal Industry, Department of Agriculture, for the inspection of meats. It is undoubtedly true that the Federal Government has the power to create such an inspection department. The benefits which would possibly accrue under such an inspection would doubtless be great. The expense, however, would be considerable, and it is questionable whether the benefits to be derived would be commensurate with the cost, for it is undoubtedly true that the total expense would be greater for such an inspection to be undertaken by the Federal Government than for the same to be set in motion and conducted by the various States in which oyster grounds are located. Moreover, the work of supervising the production and distribution of oysters would be an infinitely greater task than the supervision of the slaughter and distribution of fresh meats, and the expense would be proportionally greater. Then, too, there is not the export trade in shellfish that there is in meats and meat products, and there is not, therefore, the same demand from foreign consumers for Federal inspection as there was and is in the case of meats and meat products.

While the powers of the various branches of the Federal service in the control and supervision of shellfish are, to a large degree, limited, there exists, in the various State governments, the inherent right to authorize their various administrative departments to undertake even the most elaborate supervision over practically every aspect of the oyster industry. One or more administrative departments could be clothed with the power to make rules and regulations and to supervise the various aspects of the oyster industry, and especially to prevent the entrance into the commerce of that State of any oysters or shellfish not produced and distributed in a thoroughly sanitary and hygienic manner. Moreover, there is no doubt that the various States have the constitutional right to make statutory provision for the prevention of pollution of tidal or other waters, when such pollution would be detrimental to the cultivation of foods or food products.

It is true that the legislative authorities of many States are loath to grant too high a degree of autocratic power to their administrative departments. In some States the principle of home rule for municipalities has been a governing factor in State legislative action for several generations, and, while the most autocratic powers are given to administrative departments of municipal service, only limited powers are granted to State administrative commissions organized to deal with much the same problems. The general tendency has been, in the majority of States, to limit the powers of the State administrative departments to that of investigation and supervision of the activities of local and municipal officials, and to refrain from giving, to such State administrative officers or commissions, powers of direct dealing with matters which may have very large and important local bearing.

It is true that a number of States have created shellfish commissions having jurisdiction over all or a large part of the shellfish grounds located within their borders. Some of these commissions have greater powers of supervision and control than are granted to the State boards of departments of health in the same States. In some instances, as in New York, the State department of health has the power of investigation, and reports its findings to the conservation commission, but the latter body has the power of control.

The lack of uniformity of method of investigation and supervision in the various States is an expression of the lack of uniformity of method of government as established by precedents in these respective States. This is undoubtedly an incurable condition, in so far as the near future is concerned, and is a factor which must of necessity be taken into consideration in all efforts made to promote a higher degree of efficiency of State action in the sanitary control of not only oysters and shellfish, but all food products. It is doubtless this variation in the method of expression of State power which has increased the demand for Federal supervision, but, as we have already said, the remedy for the situation does not appear to lie in that direction. In fact, it would appear to be the case that no remedy for the lack of uniformity exists other than the slow process of evolutionary development by educational measures.

It is proper to recognize, however, that notwithstanding the variability of method, there has been, in many of our States, pronounced activity in the control and supervision of the sanitary conditions of the oyster industry, and it is undoubtedly true that more rapid progress will be made in the near future, and that the degree of supervision which the industry will probably require will doubtless be obtained within reasonable limits of time.

In returning to the question of the municipal supervision, it can be stated that past experience has shown that the most effective method of municipal control of the sale of foods has been through some form of licensing or permit system. Under the operations of such a method, information concerning the methods of conduct of the business under license can be readily obtained by the official supervising department as a requirement prior to the granting of the permit. The burden of obtaining this information is shifted from the official department to the industry itself. This is obviously the most effective method of obtaining accurate data. The official department is also provided with an effective means of quickly correcting any obvious infraction of any rules and regulations which they may make to govern the conduct of the various aspects of the business. A threat, even of the revocation of a permit, is a more powerful weapon than the haling into court and conviction of an individual.

It is obvious that the official department of a municipality should not grant permits or licenses until the sanitary requirements for the industrial processes have been thoroughly stated and determined. nor should licenses be given to individuals or corporations until they have submitted proper evidences of adequate equipment for the establishment and systematic continuation of their business in full compliance with the rules and regulations made by the official department.

It is true, however, that under some circumstances it is appropriate to issue preliminary permits for the conduct of business, with the object of obtaining, not only further information, but opportunities for an economical investigation of conditions, the results of which will enable the department to draw up and put in force appropriate and adequate rules and regulations or provisions of a municipal sanitary code.

From the statements made in the first part of the discussion of this subject, it is obvious that a municipal department should have at its command accurate information concerning the oysters entering into the markets of the community, especially on the vital points as already described. During the nonhibernating season of the year, which, under the temperature conditions in New York and vicinity, exists from the middle of April to the middle of November, it should have furnished to it by each firm or individual engaged in the business of shipping, distributing, or retailing oysters within its limits, definite information as to the processes applied to the oysters which are to be consumed in a raw state, with special reference to whether these have been subjected to any floating, drinking, or washing processes; that is, if the processes have been applied, or are likely to be applied, to any of the stock to be handled by these individuals. Detailed descriptions of the processes, and the exact location of the drinking, washing, or floating grounds, should also form a part of the data submitted.

Using such information as a basis for investigation, the municipal department should conduct complete sanitary surveys of the drinking grounds involved, and should make periodical laboratory examinations of oysters submitted to such processes in their respective locations. It is obvious that, if this work of inspection or of laboratory investigation has been adequately conducted by a State department or commission, the results of such investigations or examinations should be made available for the use of the municipalities of that or any other State.

In some instances various branches of the industry have organized and provided for a private sanitary and laboratory investigation of their grounds and stock, and, in the absence of adequate financial ability on the part of the municipality to make its own investigations, and in the failure of States to conduct similar investigations and studies, the results of such private investigations might be properly considered by the municipal health authorities.

In so far as the northern part of the United States is concerned, the distribution of oysters for consumption in the raw state is confined to the season beginning about the first of September and extending to the latter part of April. The number of oysters consumed during the remaining portion of the year, which is largely the warmer summer months, is extremely limited. It is true, however, that such business as is conducted in oysters for consumption in the raw state during the summer months requires as much supervision as that of the early fall months, which is infinitely greater in amount.

While "floated" oysters are probably the only type which is capable of transmitting infection, and then only during the warmer months of the year, it is likewise true that the floating process is more likely to be carried on with, and is almost an industrial requirement for, some of the stock from certain locations during the early fall months. This, then, is the time for the concentration of supervisory efforts.

The burden of official supervision, therefore, is determined by the life cycle of the oysters and the practical requirements for the conduct of the business. The important point is to determine the sanitary conditions of the drinking places during the late summer and early fall months. When this has been accomplished, it will doubtless be found that oysters taken from waters in at least the more northern sections of the Altantic coast have ceased to be a factor in the transmission of infectious diseases.

DISCUSSION.

Dr. George A. Soper: I heartily agree with what I understand are Dr. Pease's opinions with respect to the need of sanitary supervision over the oyster industry, although I entered the room too late to hear his paper read in its entirety. Observations of many years, covering the customary methods employed in cultivating oysters and preparing them for market, and investigations of outbreaks of typhoid fever, have given me a good deal of sympathy with the producers, and led me to believe that the danger of transmitting disease by shellfish has often been exaggerated. In practically every case of proved infection from oysters the pollution has been direct and immediate; that is, the sewage has passed by a short route, and in a brief interval of time, from the sewer to the shellfish. At the same time it appears to be impossible to say just when shellfish will be free from danger of pollution, and until further studies are made of this subject we should look at the matter in a conservative way. Perhaps the wisest course is to consider that oysters which are taken from polluted water are polluted themselves, and that it is unsafe to eat shellfish in raw condition which are taken from water that would be too polluted to drink.

There is need of education with regard to this subject. Oystermen, and particularly the smaller producers and dealers, are commonly unable to understand how disease can be transmitted by microbes, and I have seen misguided men open and eat shellfish which I have known to be polluted, with the object of convincing me that there was no cause to fear disease from them. It is difficult to teach such men, and they must be dealt with diplomatically. With the larger producers who have much capital invested, and who can well afford to pay for expert advice, the case is different. They should be well informed upon the sanitary aspects of their business, and compelled by rigorous measures, if necessary, to adopt safe practices. If this is done, the small dealers will follow the larger ones, and eventually learn to keep their shellfish free from contamination.

There is a common belief that the floating, or drinking, of oysters is a dangerous practice, and should be forbidden. Floating is not harmful, if the water is clean. Restrictions should not be placed against floating, but against floating in contaminated water. Floating may be beneficial. It sometimes happens that large quantities of oysters are thin and unmarketable until they are floated, when they swell, look inviting, and taste palatable enough to those persons who are accustomed to eat their shellfish with horse-radish, tomato catsup, and other highly seasoned condiments. To forbid floating under such circumstances would be to bring unnecessary hardship and loss to the oystermen, to whom floating, in one form or another, is sometimes indispensable.

The places where oysters are floated are much safer to-day than formerly, particularly in the territory around New York, with which I am most familiar. Places like the Rahway River and Bodine Creek, both of which empty into New York Harbor and are heavily polluted with sewage, have been given up, and, since the New York Bay Pollution Commission pointed out the abuses connected with this subject, in 1905, the city and State departments of health have done much to regulate the wholesomeness of the shellfish supply of the metropolis.

The work of many investigators and the restrictions of various boards of health have produced good results up to the present time, but the scope of the activities of those working for wholesome shellfish supplies should be broadened. I would particularly call attention to the possibility of transmitting disease through clams. Hard clams, known in the vicinity of New York as Little Necks, in New England as quahogs, and among scientists as Venus mercenaria, seem by nature especially suited to transmit disease. Unlike the oyster which requires a rather firm, clean bed, the hard clam grows well in a muddy bottom. Sewage sludge itself is not unfavorable to it. It is not unusual to see persons digging hard clams close to the mouths of sewers. After a very short period in market this form of shellfish is often eaten raw. Hard clams are particularly in favor during those warm months when oysters are out of season and diarrheal diseases are most common. It would not be at all surprising if many outbreaks of diarrheal disease at seaside summer resorts were traceable to hard clams taken from near-by polluted sources.

If there is no peculiar faculty possessed by the hard clam for destroying the germs of disease with which it may become contaminated, it would seem desirable that the restrictions which boards of health have placed against contaminated oysters should be made to apply equally to it.

What are known as soft clams in New York, but are simply termed clams in New England, are more often found in sewage-polluted localities than are oysters or hard clams. They grow deeply buried in sand or mud, and are dug out of their resting places when the tide recedes and leaves their beds bare. Heavily polluted shores are among the most prolific sources of soft clams, and large quantities are annually taken from situations of this kind. Fortunately, the soft clam is rarely eaten in a raw state, and the cooking which it receives is probably sufficient to remove much of the danger. All chance of disease is not, however, removed by cooking. The hands of those who gather and handle shellfish may easily be contaminated, and infective material may be transmitted to bread and other food which is subsequently eaten. I have seen typhoid produced in this way.

Unlike oysters and hard clams, which are now extensively planted and grown for market, soft clams are taken only in the wild state. The demand for them is comparatively small in New York and vicinity. The persons who gather them usually consume them in their own homes, or distribute them among friends. To control the purity of soft clams will be more difficult than to prevent the pollution of oysters, but the beneficial results to be obtained would seem to make the effort well worth while. So far as I am aware, nothing has yet been done to regulate this possible source of infection.

THURSDAY AFTERNOON, SEPTEMBER 26, 1912.

ANTITYPHOID INOCULATION: THREE YEARS' EXPERIENCE WITH ITS USE IN TRAINING SCHOOLS FOR NURSES IN MASSACHUSETTS.

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Pfeiffer's experiment which led Wright to introduce antityphoid inoculation into the British Army was more far reaching than one could have imagined at that time. All are familiar with the extensive work which has been accomplished on these lines in the English, German, and United States armies.

Inoculation material has been most varied. Heat-killed vaccines have been the most popular and, in fact, the only preparations used to any considerable extent in man. But animal experiments and a few human inoculations have been attempted with other material. Vincent [1] recommends macerated organisms sterilized by ether. Müller [2] has treated cultures with lecithin and extracted the product with chloroform. Rusznyák [3] has used the typhoid immune serum, while Besredka [4] and Bessau [5] have employed mixtures of the serum and dead organisms. Chemical agents, such as silver salts, glycerine, sodium carbonate, formaline, and carbolic acid, have been widely used to sterilize cultures. Macfadyen [6] has employed frozen, powdered, and filtered organisms. But the most extreme method is that of Castellani,[7] who employs on his third and fourth injection living organisms which have been attenuated by an exposure to 50° C. The advantages and disadvantages of these methods, although worthy of prolonged discussion, can not be considered at the present moment.

All practical work has been accomplished in artificial typhoid immunity by means of heat-killed vaccines. Pfeiffer and Kolle [8] and Wright [9] recommend heating to 60° C., but Leishman [10] and Russell [11] advise only 53° C. In my work I was guided by the careful researches of Maj. Leishman and others of the British Commission,[10, 12, 13] whose work alone at that time seemed complete.

It is well recognized that the typhoid bacillus is the greatest foe to the soldier in the field. During the last century nearly all the armies of the civilized world have been devastated by this infection, but the dangers of typhoid communication were not fully realized until the discovery of the specific organism by Eberth, in 1880, followed very shortly by its demonstration in the various excreta of the body.

It was shown by Joslin and Overlander [14] that the nurses of Massachusetts were eight times more liable to typhoid infection than others less intimately associated with the sick. For the 10 years ending in 1908, from two to four nurses contracted typhoid fever each year in the Massachusetts General Hospital alone. According to my statistics [15] there was a morbidity of 1.4 per cent among the nurses, as compared with Joslin's estimate of 1.41 per cent among the nurses of most of the large hospitals of Massachusetts. This unnecessary prevalence of typhoid fever in the best regulated of our hospitals caused Dr. Mark W. Richardson, secretary of the State Board of Health, who had long been interested in the disease and its prevention, to bring the matter before the governing boards of the Massachusetts General Hospital. Their response was prompt and decisive, so that inoculation was started there at once and has been continued regularly up to the present time.

In order to produce immunity in such a class of individuals, it was necessary to demonstrate the safety of the process and the relative ease with which it could be accomplished. To bring about this result, I proposed the use of small doses, frequently repeated, of a low virulence vaccine. My vaccine material was and still is essentially the same as that used by Leishman and Russell.

TECHNIQUE.

In my work the technique is briefly as follows: The stock culture was isolated from the spleen of a case of typhoid fever in 1902, so that its attenuation has been considerable. Its killing power with animals is four times less than that of a similar culture only 1 year old. The organisms, grown on agar slants for 24 hours, are killed by an exposure to 53° C. in the water bath for an hour. Standardization is made with the Zeiss blood platelet counter. Injections are four in number, and are given at five-day intervals. The doses, which vary somewhat with the size of the individual, are 100, 200, 400 to 600 millions. For small women and children, the amount of the vaccine is proportional to the body weight.

The site of injection is preferably in the left interscapular region, but many inoculations have been performed at the insertion of the left deltoid. The latter seems less convenient, because of the considerable muscular activity in the neighborhood of the swelling which occurs in almost all instances. Alcohol is used as a local antiseptic. When large numbers are to be inoculated at one time, several syringes, which are boiled between injections, are used, care being taken to cool the syringe before the vaccine material is introduced.

REACTION.

It is a well-recognized fact that debilitated people present the most profound reactions, and I have observed that latent and chronic disease of a nontyphoidal character may be made active by an inoculation. I have avoided vaccination in such individuals, especially tubercular patients, but I have suffered a few accidents through improper histories. In this way a temporary, but not serious, acute exacerbation has taken place in three chronic arthritides, a chronic cholecystitis, a subacute urethritis, and quiescent cases of furunculosis and acne. The duration of these untoward effects was, however, very short.

The safety of my work necessarily calls forth a discussion of the "negative phase" so strongly supported by Wright, Morgenroth, and Vincent. Since many of the nurses are exposed to the disease during inoculation, a period of diminished resistance would be of great danger. But Pfeiffer, Leishman, and Russell have shown that the period following injection is one of increased resistance. This is in perfect accord with the small morbidity of typhoid among these nurses and 80 others who were most intimately exposed to the disease before and during inoculation. In this light, it is an interesting and important fact to note that the few who were inoculated during the incubation period presented a milder form of the disease than those from whom the infection arose.

The reactions have been reasonably slight. Locally, the site of inoculation presents a tender, painful wheal. When a vein is accidentally punctured, a more severe local reaction results, the swelling and ecchymosis persisting for several days. The neighboring lymphatic glands may become enlarged and tender. The duration of the latter symptom is very short, however, and the local soreness rarely lasts more than 24 to 36 hours. The constitutional reaction in my latest personal cases, some four hundred in number, is as follows:

	Per cent.
Absent or slight	86
Moderate, i. e., malaise, headache, and fever not exceeding 100.5°	10
Severe, i. e., vomiting, diarrhea, chills, and fever reaching 102° to 103°	4

These symptoms last from 12 to 24 hours, rarely 48 hours. Furthermore, in only five instances has a moderate or severe reaction been produced in any individual by more than one of the four inoculations. Fifty per cent of the moderate reactions followed the second injection, the first and third dividing the remainder nearly equally. Among the severe reactions 50 per cent were produced by the third, the first and second dividing the remainder. Only very rarely does the fourth inoculation produce any discomfort. I have observed that when inoculation is started on the eve of catamenia, or during the early days of the flow, constitutional reactions are apt to be more severe. As a result, I plan as far as possible not to have the first two injections fall within those days.

HOSPITAL INOCULATION.

During the first year my work was limited to the Massachusetts General Hospital, but since that time, through the efforts of Dr. Richardson, inoculations have been performed by me or under my supervision among the nurses and others intimately exposed to the disease in 23 hospitals in Massachusetts. In all, 1,662 individuals have received this treatment. The result of hospital inoculations is told in a word by the following table:

Individuals inoculated in hospitals		1,403
Individuals uninoculated (but exposed) in same hospitals		674
Cases of typhoid among the inoculated—excluding 3 who were inoculated during the incubation period (1 of these was a paratyphoid infection)		3
Cases of true typhoid among inoculated		2
Cases among the uninoculated (9 of these were paratyphoid cases)		17
Cases of true typhoid among uninoculated		8
Morbidity among inoculated	per cent	0. 14
Morbidity among uninoculated	do	1. 19

The last figure is somewhat lower than those of Joslin [14] and the writer [15] quoted above. But it shows what may be expected among such large numbers of nurses unprotected by inoculation. The marked reduction among the inoculated needs no further comment. The two cases contracted among the inoculated occurred in the following manner: One nurse, a year following inoculation, had cared for two fatal cases of typhoid without her hospital. Her disease was severe, but was followed by recovery. The other, two years after inoculation, while caring for several cases, received in the mouth some typhoid material. Although the mouth was washed with antiseptics, a mild infection followed.

In the Massachusetts General Hospital, where inoculation has been in progress for three years and where over 80 per cent of the nurses and others exposed to typhoid have been protected, no cases of typhoid fever have been contracted. The following table illustrates exposure in the medical wards, during the typhoid season, of 90 nurses, who have completed their course, and of 92 who are still in training:

	Average months of typhoid duty after inoculation.	Average months of typhoid night duty.	Percentage of nurses serving night duty during typhoid season.
Pupils	2. 42	0. 54	42
Graduates	2. 88	. 64	47
Total	2. 64	. 59	44

The high percentage of inoculated nurses serving night duty during the typhoid season is most suggestive, since that class furnishes most of the cases of the contracted disease. In all fairness, it must be stated, however, that rather fewer cases of the disease have been treated in the hospital during this three-year period. But this reduction is in no way proportional to the decrease of the incidence above noted.

BLOOD CHANGES.

Agglutination reactions have been performed by the microscopic method because of its ease, accuracy, and its moderate value. The first 100 cases showed positive reactions in the following dilutions two weeks after inoculation:

	Per cent.
1–50 or greater	80.6
1–25 or greater	94.2

Macroscopic agglutination reactions, at an equal interval, show positive results varying between one to one-thousand and one to ten thousandth. This quality of the blood persists to a considerable degree for two years, but is still evident after two and one-half years. (See fig. 1.)

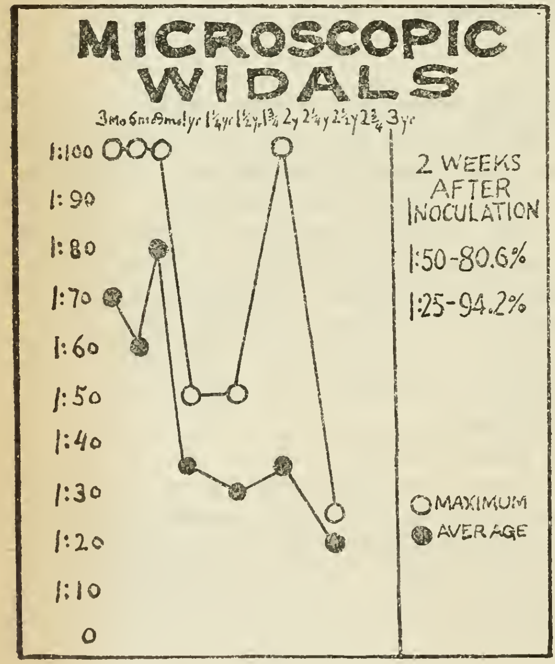


FIG. 1.

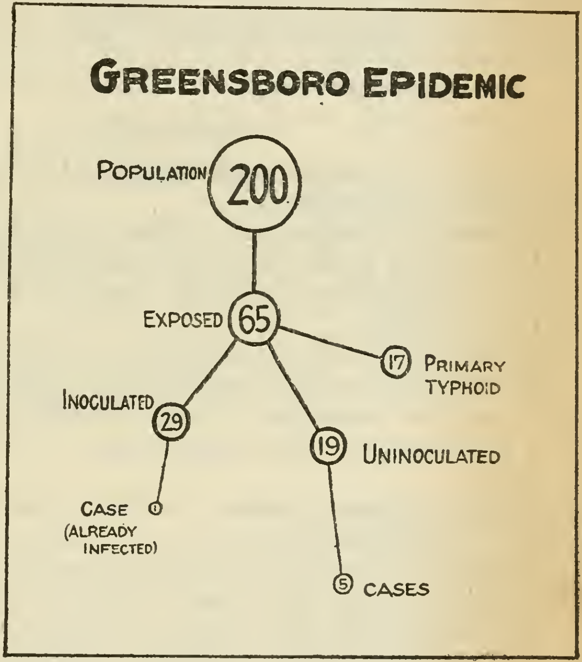
That an immunity exists in the presence of a positive agglutination reaction of even mild degree is most reasonable. But the converse is not true, since all are familiar with the usual transient character of the antitropic substances of the blood following an attack of the disease itself. Further investigations of blood changes, i. e., bacteriolysins, opsonins, and so forth, have not been carried out, since those points are now well established.

EPIDEMICS.

The employment of this treatment in epidemics has been very meager. This has been due no doubt to the fear of the so-called negative phase. It has been attempted twice by me. In one instance, the infection proved to be paratyphoid, and the results, though interesting, are of no great value. They are as follows:

	Per cent.
Morbidity among inoculated	6.6
Morbidity among uninoculated	12

These figures are somewhat striking, since each class embraces an equal number of individuals. Over 80 per cent were inoculated during the incubation period, a fact which detracts considerably from the value of the statistics. But, in spite of this, there is a considerable reduction of morbidity, and only two cases appeared after inoculation was completed. Inoculation during this epidemic was of very doubtful value.



The second epidemic was of greater interest, and the results proved more satisfactory. The water supply of a limited number of people in a little Vermont village became contaminated with the typhoid organism from the excreta of an isolated individual who had died from the disease six months prior to the epidemic. The original primary cases, 17 in number, appeared simultaneously. Within a week, 29 of the remaining 48 who had been exposed to the disease through the water supply had been inoculated; 19 remained uninoculated. Among the latter, five cases developed; among the former, one. The latter presented his first symptoms immediately following his first inoculation. His disease was of a very mild variety.

The small size of this epidemic forbids drawing too broad conclusions, but it seems rational to advise the employment of this treatment, since no harm appears to result when the vaccine is given in a judicious manner. Furthermore, the absence of cases contracted among the inoculated in this epidemic, and in several isolated cases of immediate exposure, seems to be far from a coincidence. Inoculation in the time of epidemics must be performed with care, since it is inevitable that many must be inoculated during the incubation period. The result of this accident is, however, not serious. My experience would indicate that the onset of symptoms was hastened by this step, but that the infection was shorter and of a less severe character, possibly because of the destruction of organisms before they had multiplied to a sufficient extent to produce a natural reaction from the unassisted body.

Including this epidemic, and other personal cases, the final statistics are as follows:

Inoculated individuals		1,662
Uninoculated individuals		700
Cases among inoculated (excepting those mentioned)		2
Cases among uninoculated (with similar exceptions)		13
Morbidity among inoculated	per cent..	0.12
Morbidity among uninoculated	do....	1.86

CONCLUSIONS.

Frequent injections of small amounts of a low-virulence vaccine cause slight inconvenience.

They seem to produce a protection among nurses who are eight times more liable to the disease than the average individual.

Their morbidity under ordinary conditions is 1.4 per cent, or 20 cases among 1,403.

Only two cases developed under these conditions.

Case morbidity among the uninoculated is nearly nine times greater than among the inoculated who are subjected to similar conditions.

No permanent untoward effects have arisen from over 5,000 injections.

The blood picture indicates a certain protection lasting at least two and a half years.

The use of this means of protection has been shown to be safe, in two epidemics, and very efficient in at least one of them.

I am deeply indebted for their careful work in completing subsequent inoculations and for excellent records to Dr. E. M. Crane, of Hardwick, Vt., and to those physicians in charge of the hospitals in which inoculation has been introduced.

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[2] Müller: Zeit. f. Immunit. u. exp. Therap., 1910, 1. Teil, 5, p. 587.
[3] Rusznyák: Centralbl. f. Bakt., 1911, I. Abt., 58, Orig., p. 134.
[4] Besredka: Ann. de l'Inst. Pasteur, 1902, XVI, p. 918.
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[6] Macfadyen: Brit. Med. Jour., 1903, I, p. 882.
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[12] Harrison: Jour. Roy. Arm. Med. Corps, 1907, VIII, p. 472.
[13] Leishman, etc.: Ibid., 1908, X, p. 583, and XI, p. 327.
[14] Joslin & Overlander: Bost. M. & S. Jour., CLVII, p. 427.
[15] Spooner: Amer. Journ. of Pub. Hyg., 1909, XIX, p. 616.

COMMUNITY IMMUNIZATION AGAINST TYPHOID FEVER—AN EXPERIENCE OF ABOUT 25,000 VACCINATIONS AGAINST THE DISEASE IN MEN, WOMEN, AND CHILDREN.

Dr. M. Goltman, superintendent of health, Memphis, Tenn.

Outline of the general health conditions of the city, and a brief statement as to the sanitary condition of the water supply at Memphis, Tenn.

Typhoid fever. Infection of water supply. Advent of the premonitory diarrhea. Relation of these bowel complaints to typhoid. Appearance of typhoid; limited to the contaminated section.

Precautions taken in the way of general sanitary disinfection in the overflow district. Precautions taken in furnishing pure water in the contaminated district. Recession of the flood. Purification of the contaminated water and water mains.

Educating the public as to typhoid fever through the means of the public press. Educating the public through the press as to the value of vaccination against typhoid fever. Furnishing free vaccination and vaccination records to all physicians applying for it. Opening of a special vaccination dispensary for white and colored. Response of the public as shown in about 25,000 vaccinations against the disease. The result: April, 43 cases and 1 death; May, 304 cases and 47 deaths; June, 42 cases and 8 deaths.

DISCUSSION.

Dr. John W. Brannan: I heard Dr. Spooner's paper, at Atlantic City, last May, in which he related his experience up to that time with the antityphoid inoculation of the nurses in the Massachusetts General Hospital, and I returned to New York with the intention of having the nurses inoculated in the hospitals with which I am connected—Bellevue, Gouverneur, Harlem, and Fordham. I had not expected to make the inoculations myself, but there seemed at the time to be no one else to do it. I began the work in June, first having myself inoculated by Dr. Norris, the director of pathological laboratories of the hospital. He used the Army vaccine, giving as the first dose one-half cubic centimeter containing 500,000,000 killed bacilli. This was followed at intervals of 10 days with a second and a third dose of 1 cubic centimeter each. With each inoculation the arm at the point of injection was somewhat painful, tender, and swollen for 36 or 48 hours, the tenderness and swelling extending up and down the arm for a few inches. The general reaction consisted of a fairly severe headache, pain in the back, and some malaise, these symptoms lasting for about 24 or 36 hours. After I had received the second inoculation, I proceeded to treat the nurses, using vaccine furnished by the board of health, and, in the course of the summer, I inoculated some 150 nurses in the hospitals, and also about 50 members of the house staffs, as well as some six or eight private patients, the latter being all men. There were very few severe reactions, these being much more marked among the men than among the women. Not more than two nurses asked to be relieved from duty for a day, whereas several of the internes were laid up for as much as two days at a time with temperatures ranging as high as 102°, and rapid pulse, nausea, vomiting, severe headache, and pain in the back. One of the doctors had a temperature reaching 103°, following each of two doses, both of them only one-half cubic centimeter. He had also what he described as a "splitting" headache, lasting for 36 hours, accompanied with great prostration and pain in the abdomen. Since the second inoculation (he has not wished to take a third) he declares himself as feeling better than ever before in his life. There had been very little typhoid among the nurses in Bellevue or any of the other hospitals, so that there seemed to be no particular reason for giving the prophylactic inoculation, but I urged that it should be done, not only to protect the nurses while on duty in the hospital, but as a general measure of precaution, especially as many of them were about to take their vacations in the country, where they would be exposed to infection from sources beyond their control. No compulsion was exercised, but the nurses were advised that it would be to their advantage to undergo the inoculation. The great majority of the pupil nurses responded quite willingly, but a number of the graduates, who come for short periods of postgraduate instruction and experience, asked to be excused.

As I had heard of the occasional lighting up of latent diseases, such as arthritis, to which the reader of the paper has referred, I inquired particularly as to whether anything of the kind occurred in these cases; but, so far as I know, nothing of the sort happened. It may also be of interest to know that the reaction was the same in the cases that had had typhoid as among those who gave no history of the disease. When some of the nurses and some of the doctors suggested that, as they had had typhoid fever, perhaps it was not necessary for them to be inoculated, I replied that not only did that not imply that they could not have the disease again, but also that from a scientific standpoint it would be interesting that they should receive the inoculation as "controls." They were not particularly impressed with my suggestion, which did not seem to appeal to their scientific spirit, but they accepted the treatment just the same.

Some of the private patients who came to me for inoculation did so because they were about to go abroad, fearing that they might be infected with food or drink in the course of their travels. This argument is rather amusing when we consider that typhoid fever is much more prevalent with us than it is in European countries. A recent paper, by Dr. Allen C. McLaughlin, of the United States Public Health Service, shows that, in 1910, in some 25 European cities, there were 6.5 deaths in 100,000 population, whereas, in this country, in an equal number of cities of the same character, there were 25 deaths in the same number of population. In other words, there is four times as much typhoid fever in the cities of the United States as in those of Europe, and as we know that there is more typhoid in the smaller towns and in the country districts than in the large cities, it would seem to be much more reasonable for those who are about to spend their vacations in the country regions in the United States to be protected by inoculation than for those who are going abroad.

I should like to ask the reader of the paper how much significance should be attached to a positive or negative result, after the Widal test, in the case of those who have received the prophylactic vaccine. In my own case, the test gave a positive result after the third inoculation in dilution of 1 to 40, but not beyond that; whereas, in the case of one member of the house staff of Bellevue, he said that the test was positive in the dilution of 1 to 200 after the first inoculation, and therefore refused to continue the treatment, not believing it to be necessary. My own impression was that the negative reaction was of no particular significance, but that the positive reaction implied at least a certain amount of immunity.

I should also like to ask if the reader of the paper, or anyone else present, has had any experience with the employment of sensitized bacilli instead of killed bacilli. In the New York Medical Journal of last week, reference is made to the method of Vesredka, in which 500,000,000 to 750,000,000 sensitized living bacilli are given as a first dose, to be followed by a second dose of double the quantity some seven to nine days later. It is stated that there is no general reaction, and only an insignificant local reaction, following each injection. The paper to which the Medical Journal refers is by Alcock, and is published in the Lancet of August 24. It is also stated that all authors agree that the vaccination by living micro-organisms is more effective than when the dead organisms are used. If this be true, and the reaction is less severe, it would seem to be well for us to make use of this newer method, provided it can be proved to be free from the danger of conveying typhoid fever.

Dr. H. G. Dorman, Beirut, Syria: Dr. Goltman calls attention to the fact that 500 children between the ages of 1 and 4 years were inoculated with the adult dose and tolerated it even better than the adults did. A limited use of antityphoid inoculation among children has impressed me in a similar way with the peculiar tolerance of children for this inoculation. This is in accord with the well-known tolerance of young children for typhoid fever itself. The absence of unpleasant after effects of the inoculation in children would seem to justify a wider and freer use of the vaccine among the little ones.

Dr. W. G. SCHAUFFLER: In the National Guard of New Jersey about 300 to 400 men have been inoculated during the past summer, with no bad results in the way of after effects. No men have lost time from their work.

In private practice a marked case is that of a mother and a nurse, who were undoubtedly infected from a severe case, but who were rendered immune by immediate inoculation.

Dr. EUGENE R. KELLEY, commissioner of health, State of Washington: The Washington State Board of Health has been furnishing the typhoid prophylactic to health officers, and later to any physicians on their request. There has been a slowly increasing demand for it. It has also been used very successfully by the chief central surgeon of the railroad construction company among the men, his practice being to inoculate only after typhoid had occurred in a man working in a camp. He then urged the remaining men in the camp to take the prophylactic inoculation. He also urged the necessity of avoiding the use of the term "vaccination" when using the prophylactic among laborers, as the term is associated in the minds of the laity with smallpox vaccination only.

In these camps careful sanitation was also maintained, with the result that only 2 cases have occurred in the camp this season, while about 200 cases occurred in a similar group of camps in a similar environment during the previous year.

Dr. LESLIE L. LUMSDEN, United States Public Health Service: I regret that we could not hear the complete paper of Dr. Goltman. The abstract of his paper, as I understand it, points to the conclusion that inoculation against typhoid, as it was practiced in Memphis, is, so far as can be determined, practically harmless, but does not show definitely that the inoculation necessarily had any very marked effect in checking the epidemic.

That antityphoid inoculation has a field of usefulness, I am convinced. The evidence appears conclusive that the inoculation gives a certain protection against typhoid infection. There seems to have arisen an undue amount of enthusiasm about antityphoid inoculation. It is well enough to arouse enthusiasm for any measure which will be of use in typhoid prevention, but we should not lose our perspective and attach too much importance to one measure to the neglect of other and equally important measures. I think inoculation should be regarded as a useful adjunct to, but by no means as a substitute for, sanitary and hygienic precautions in campaigns against typhoid fever.

Dr. Spooner: My experience agrees with that cited by Dr. Brannan. Far greater reactions have arisen among nurses and physicians who are thoroughly familiar with the reaction symptoms. Among private patients, who are not in such an expectant frame of mind, the reactions were much less severe. For this reason, it is my opinion that the excessive reaction found among the physicians inoculated by Dr. Brannan is due rather to their apprehension than to their sex.

Constitutional reactions are more severe among those who have already had an attack of typhoid fever.

The chief disadvantages in the use of sensitized vaccines are threefold—the use of such material is accompanied by some danger, it is associated with as much discomfort as is the case when killed bacteria are employed, and it may produce "typhoid carriers."

All are agreed that the advent and advance of antityphoid inoculation should not be at the cost of any neglect in the general hygienic prophylaxis against the disease.

SMALLPOX AND VACCINATION IN SIAM.

Paul G. Woolley, M. D., delegate for Siam, Cincinnati, Ohio.

Smallpox is one of the most dreaded and destructive of the scourges of Siam. The oldest records to which I have had access in the Royal Library in Bangkok mention it and confuse it, as it was confused before the time of Rhazes, with measles, and as it is still frequently confused with chickenpox and possibly other diseases. In these older writings it is described so exhaustively and with so much play of the imagination, that it is almost impossible not to see that it was confused with all sorts of eruptive disorders.

In ancient times no general precautions were taken to prevent the spread of smallpox. There were sporadic attempts among the hill tribes to keep the disease from their villages by making barriers of trees across the roads, thus obstructing travel, and by allowing none to enter and leave the village until all danger was past. If, in spite of these precautions, the disease finally entered the village, the place was deserted and the empty houses and sick persons were left.

Some of the people, who had less real fear of the disease, were wont to expose their children in houses occupied by victims of the disease, in order that they might contract smallpox, recover, and become immune.[1]

It is possible that inoculation also was used, but no direct reference to it is known prior to the account given of it by Bradley.[2] He says:

> There was once a very extraordinary awakening of the Siamese mind to do something to modify the virulence of smallpox. It took place in the latter part of A. D. 1838. That annual scourge was usually widespread and malignant at that time. Great efforts had been made by the missionaries every year for the four previous years to introduce vaccination, but all in vain. Being surrounded by the smallpox, with scarcely any hope of shutting it out from their own families, they then felt constrained by the Providence of God to endeavor to save their children by inoculating them with

smallpox. The blessing of the Lord made it a complete success, every one of the subjects of the experiment having taken the modified smallpox in the mildest form. His late majesty, the King of Siam, being informed of this, sent a body of the royal medical faculty to the missionary physician to inquire into the matter, and it was a very novel and exciting event for those early years of Protestant missions to be visited by such a committee from such a monarch. Those servants of the King were very particular and thorough in their inquiries, for they had a great charge in hand and a stern master to serve.

About that time there was issued (from the press of the A. B. C. F. M. in this city) a little tract in the Siamese language, setting forth the advantages of inoculating for smallpox over having it in the natural way, and the wisdom of the former course when the scourge is pressing fearfully upon one, and it is impossible to obtain the vaccine virus. A copy of this was sent to the King, and it was eagerly sought for and read by princes, lords, and the commoners. Presently 10 or 12 royal physicians were ordered by the King to visit the missionary physician daily, for the purpose of seeing his practice in inoculating and treating the smallpox thus modified and divested of its virulence, and, in this way, to qualify themselves for inoculating in the royal palace. Having faithfully studied the art a few days with praiseworthy proficiency, they were armed with lancets and required to inoculate all that were unprotected in the palace of the King, and in the palaces of the princes, and in the families of the lords and nobles, and other officers of the Government, in the city and out of the city. Other native doctors were encouraged by the King to follow this royal example, which extended the work, it is believed, into many of the Provinces of Siam.

Inoculation was then the engrossing business and care, not only of nearly all the native physicians, but also of a large proportion of the better classes of the people, from the beginning of the year 1839 until the month of April. It is impossible to estimate the many thousands that were within that period inoculated; and it is a very remarkable fact that among them all there was not, probably, more than 1 case in 500 that proved fatal, until the hot season was ushered in, when the work became so much less successful that it was suspended.

So generally was inoculation accounted a perfect success that those who had been waked up and blessed by it wished for nothing better to take its place; and consequently it became subsequently an obstacle to the introduction of vaccination, because it was regarded almost as safe, and always a more certain protection against smallpox in the natural way than vaccination.[3]

From 1834 the missionaries had been making constant endeavors to obtain vaccine virus, but it was not until 1840 that they were successful. In that year vaccination was done by using vaccine scabs that had been brought from Boston by way of the Cape of Good Hope.

Dr. Bradley, through the efforts of the prime minister, Somdet Ong Yai, received permission to vaccinate 75 slave boys and girls with this material. Upon these individuals 450 insertions were made, from which three or four good pustules appeared on the sixth day after infection. From these pustules material was collected for the 100 vaccinations which were made during the following months.

Two years later, in 1842, an epidemic broke out, and all attempts to obtain active virus from Boston were unsuccessful. The missionary doctors attempted to produce vaccine by inoculating cattle, which the King placed at their disposal, with smallpox material. In this they were unsuccessful. The experiments failed, and direct inoculation was resorted to with good results.

In 1844, active material was again obtained from Boston, by the overland (Burma) route, and was propagated by the doctors, who, with the virus so obtained, made 1,300 vaccinations before the strain was exhausted.

From this time on fresh vaccine was procured every year or so, and with its aid sporadic crops of vaccinations were made. But up to 1904 there is no record that the Government made any serious attempt to produce fresh vaccine for the people.

In 1904, through the influence of Dr. Adamsen, at one time a missionary doctor, the Government was interested to the extent that it paid Dr. Adamsen and two assistants to make vaccine for public distribution. The experiments were successful; but, owing to lack of experience, very rough-and-ready technic, and the unhygienic surroundings of the cattle, the virus varied in its activity and in its content of extraneous material. Nevertheless, it was due to the public-sipirted interest of Prince Damrong and the commercial activity of Dr. Adamsen that the experiment was tried, and that it was successful enough to warrant a more modern trial.

For this trial a laboratory was built and equipped at Phrapatoom, 40 miles or so from Bangkok, the capital, and here, on August 11, 1906, assisted by an American youth, a Mr. Redfield, I vaccinated the first calf with seed vaccine from Saigon. From this calf vaccine was collected which served as the seed of that produced during the following years. From this time to the early part of 1911, at least, the vaccine made in Siam was as clean and as active as modern methods could make it.

It was during this period of the early nineteen hundreds, (1904), that Dr. McKean, in the northern part of Siam, was conscientiously endeavoring to keep a supply of vaccine on hand for the benefit of the Laos peoples. McKean vaccinated calves and produced good vaccine, but was never able to preserve his strains from gradual degeneration. Notwithstanding these difficulties, however, McKean and his assistants did 17,000 vaccinations. After the establishment of the Phrapatoom laboratory it was possible to ship fresh supplies of seed vaccine to Chieng Mai whenever they were demanded, and hence it became possible for McKean to keep a constant supply of vaccine on hand.

At the inception of the work in Siam[4] I had been led to suppose that large quantities of vaccine would be used. It was certain that a considerable percentage of the population had not been vaccinated, that smallpox was present in endemic form, and that an epidemic outbreak was imminent. The population of Siam was estimated at

6,000,000 in round numbers. The Government was willing to furnish free vaccine.

In Manila, during the year 1904–5, the serum laboratory of which I was the director made over 2,000,000 doses, and the Government had issued 1,461,433 doses for a population practically the same in numbers, but more thoroughly vaccinated. The Philippines had a compulsory vaccination act, and I had hoped that Siam would have one.

Later, it appeared that the native demands could be satisfied with a very small supply of vaccine, a supply that was represented by 167,120 doses, of which but 70,400 were distributed, and of which probably not more than two-thirds was used. It is interesting to know that a sixth of the whole supply was sold to and used by the missionary doctors, while the provincial officials received less than a tenth.

One reason for this state of affairs was that the native doctors did not understand our vaccine. The products which they had used for several years—i. e., that of Adamsen's laboratory and that from the French institution in Saigon, had been very impure and had caused not merely vesicles but sores. One doctor wrote that the "people, when they are vaccinated, are no longer sick; they do not have fever; and they do not have to go to bed. There is only a little pimple at the vaccinated place, so we know the vaccine is not good." A certain prominent half-caste doctor told me that he could not sell our vaccine because it was too pure. He said: "I know it is good, but vaccine that does not make a person sick will not do. Can't you put something in it?"

My explanations were of no avail. Letters from missionary doctors, in far-off provinces, commending the vaccine, were of no avail. One of these letters, from far down the Malay Peninsula, thanked the Government for what it was making possible, and said that 5,054 persons had been successfully vaccinated with what we had called 2,335 units. I had many such letters in my files.

The native doctors would not believe it. Arrangements were therefore made to have a demonstration, and the authorities ordered the Government doctors to go to the laboratory and watch us do the whole thing. In preparation for that event we rounded up all the unvaccinated babies in the district, and had orders to vaccinate all the cadets of the Gendarmerie School. We ordered all the vaccinated persons to report again in six days, and we had the Government doctors see them. Subsequently the complaints came from only the up-country districts, where it was said that the vaccine was not good because it spoiled in shipment. Sometimes it was six weeks in transit. We asked to have it returned, and, when we received it, we tested it on calves. We never had a failure.

His Royal Highness Prince Damrong was interested enough to write a short article explaining the whole matter, even to the method of vaccinating, and of the appearances of the lesions. He is much beloved by both Siamese and foreigners, and he helped us immensely.

The result was that the output of vaccine from the laboratory in 1907–8 was increased to 119,265 units; in 1908–9, to 145,510; in 1909–10, to 160,000; and in 1910–11, to 176,882 units.

It is interesting to note that, notwithstanding the supposed difficulty of preserving vaccine virus in an active condition, neither I, nor my successor, Dr. Edwards, nor my former assistant, Mr. Redfield, 5 experienced any serious trouble. Never did we find it necessary to resort to the rabbit method or to any other restorative procedure.

One method, that seemed to have some value, we used during the hotter seasons of the year, to preserve the vaccine at a somewhat lower temperature than was otherwise possible. The tubes of glycerinated virus were packed in tin cylinders closed with loosely fitting caps. The tubes in the cylinders were surrounded by granulated potassium nitrate, which, absorbing ever so little moisture from the surrounding air, produced several degrees' lowering of the temperature. Vaccine shipped in this way preserved its activity perfectly during any time that was necessary for transport.

I said earlier in my remarks that in 1906 Siam seemed ripe for an epidemic of smallpox. Such an epidemic occurred in the year 1908–9. Of the character of the disease the health report states that it was of a virulent type and caused a death rate of 52.6 per cent. None of the serious cases had been vaccinated. During that year but 12,395 vaccinations were tabulated in the health reports for Bangkok, which had a population of about 540,000.

The reason for this outbreak was that the population was insufficiently vaccinated. In any district or country where this is true and where smallpox is endemic an epidemic outbreak may be expected every few years, the length of time depending upon the extent of the previous epidemics and upon the thoroughness of vaccination. The following figures from the health reports of the local sanitary department, which apply only to Bangkok, indicate the number of officially known vaccinations:

1907 to 1908	3,620
1908 to 1909	[a] 22,927
1909 to 1910	5,737
1910 to 1911	8,555
Total	40,839

Population of Bangkok, 1910–11, 540,679.

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[a] Epidemic.

The figures indicating the number of vaccinations in the country districts are not available. Were they to be had they would be smaller than those shown above, except in the territory where the medical missionaries have been at work. To illustrate this, I would mention that in 1907–8 the missionary doctors reported to me that they had made 8,644, a larger number than the Government reports show for Bangkok in any but the year of the epidemic.

The population of Siam is estimated at approximately 6,000,000. If we grant that the Government vaccinators have vaccinated twice the number of persons that the reports for Bangkok show, namely, 81,678, and that the missionaries have vaccinated another 81,678, it is perfectly plain that the number of vaccinations is entirely inadequate to control the epidemic outbreak of smallpox.

Further, if we accept Highet's figures, indicating that half the male population of Siam has suffered from smallpox, even then it is still evident that the activity of the vaccinators is inadequate, and that a condition is presented that is similar to that existing in the United States, and for the same reason, namely, that in neither country is there a general law that makes vaccination obligatory.

Highet, in his report for 1908–9, says that the time was not then ripe for compulsory vaccination, because he believed that "an inefficiently administered act of this nature would be worse than none at all." This does not seem a reasonable statement in the face of the figures. It seems that it can not be true of Bangkok, with its present excellent sanitary supervision, and it is in Bangkok, with its crowded population, that the greatest danger lies.

Again, the number of second or revaccinations is entirely too small. There are no records that I can find which give the figures, but unless times have changed very radically in the past few years the people of Siam believe, as they have been taught, that a single successful vaccination is sure protection for life. At the time that I vaccinated the students at the Gendarmerie school several members of the corps who showed typical scars and one man who had had a severe case of smallpox were surprised when typical vesicles appeared. The trouble seems to be that the Siamese confuse vaccination with the old and successful inoculation, which as a rule did produce a permanent immunity. Dr. Highet has urged that revaccination at the age of 12 years be practiced. This lack of attention to revaccination is another cause of trouble in the United States. A certificate of a single vaccination at the age of 1 year should not be presumed to be of permanent value.

Then, too, many of the vaccinators in Siam are completely ignorant of the appearance of a typical vaccine vescicle. Many of them and more of the people themselves believe that any lesion appearing after attempting vaccination is a sign of success.

The above facts have been stated, not in a spirit of criticism, but as the basis for certain conclusions with respect to smallpox in Siam.

As long as vaccination is left to the whim of an individual, it will not be effective in preventing economic and social losses by reason of epidemics.

A single vaccination, even when it has been successful, is no proof of immunity. Every individual should be vaccinated at least twice, once in infancy, and once at, say, 10 years, in the absence of disease, and oftener in times of its presence. The Siamese are apt to think that a single vaccination is certain protection.

In an ignorant community, an ignorant vaccinator may do much harm with impure vaccine, by establishing a sense of false security, by reason of the fact that both the doctor and the people may believe that any sore that results from vaccination is a "take."

In conclusion, I should like to suggest that, in a country where smallpox is endemic, an act should be passed making vaccination compulsory; that children over three months of age should be obliged to be presented for vaccination; that any person not furnishing satisfactory evidence of immunity to smallpox must be vaccinated as often as the health authorities require; and that vaccination should be gratuitous when performed by public vaccinators. The government should see to it, not only that vaccinators are provided in sufficient numbers, but also that these vaccinators are trained—preferably, in Siam, at the serum laboratory, or at the laboratory of the officer of health.

[1] McKean: The Blessing of Vaccination. Chieng Mai, 1906.

[2] Bradley: Bangkok Calendar 1865. p. 50.

[3] Highet: Reports of the Health Officer, Local Sanitary Department, for the years 126 to 129 (1908–1911).

[4] Woolley: Reports of the Director of the Serum Laboratory for the years 125 and 126 (1906–1908).

[5] Redfield: Report of the Government Vaccine Laboratory for the year 129 (1911).

DISCUSSION.

Dr. Liceaga: In Mexico, vaccination is obligatory. The only system of vaccination used in Mexico is that from arm to arm. Dr. Jenner's vaccine was introduced in 1804, and since then the same vaccine has been preserved in the purest state. In more than one century, only five persons have taken charge of it. Human vaccine produces perfect immunity. The danger of transmitting syphilis does not exist, on account of the excessive care observed in using perfectly healthy subjects.

Dr. Klebs: I am much interested in the remarks made, particularly those of Dr. Liceaga. It seems that Mexico has had an expe-

rience with vaccine strains similar to that of Vienna, where Jenner's original strain has been successfully propagated for these last hundred years. It would be very interesting to know if variolization, which Dr. Woolley has shown to have been practiced successfully in Siam, was a popular method in that country, since ancient times, as it has been in India (Holwell).

Dr. Woolley: Arm to arm vaccination may be successful where there are trained doctors to recognize and guard against syphilis, framboesia, leprosy, and other communicable skin diseases. This is not true in Siam. I believe that this method is an unwise one.

VERBREITUNG VON DARMTYPHUS UND ÄHNLICHEN KRANKHEITEN DURCH DÜNNBIER.

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Mehrere der Infektionskrankheiten des Menschen finden öfters eine Verbreitung durch den Genuss von verunreinigten Esswaaren bezw. Trinkwasser. Besonders Milch ist ein nicht allzu ungewöhnliches Vehikel für Typhuskeime. Weniger gewöhnlich dürfte eine Verbreitung durch gegorene Getränke sein.

In Schweden hat ein leichtes Bier besonders auf dem Lande grosse Verbreitung als den Durst löschendes Getränk während der warmen Jahreszeit gefunden. Der Alkoholgehalt dürfte wechseln, ist aber sehr niedrig. Er überschreitet wohl selten 2 Prozent. Dieses Dünnbier wurde früher von den Bauern selbst gebraut. In den letzten Jahrzehnten sind aber überall auf dem Lande kleine Brauereien entstanden, die sich mit der Herstellung dieses Getränkes beschäftigen. Da das Brauen gewöhnlich in sehr kleinem Massstab betrieben wird und die Maschinen einfach und unvollkommen sind, wird es nicht selten eintreffen, dass der Betrieb vom hygienischen Standpunkt aus viel zu wünschen übrig lässt. Während der letzten Jahre habe ich einige Fälle von gehäuftem Auftreten von Darminfektionen nach dem Genuss solchen Dünnbiers kennen gelernt.

Im Jahre 1907 gab die Aktiengesellschaft des Zinkwerkes Åmmeberg in Schweden ein Fest für ihoe Arbeiter. Bei diesem wurde Dünnbier von zwei Brauereien vorgesetzt. Nach 1–2 Tagen erkrankten etwa 20 bis 30 Teilnehmer des Festes mit heftigem Erbrechen und Durchfall. Bei näherem Nachforschen erwieses sich, dass alle, die krank geworden waren, Bier von der einen Brauerei getrunken hatten. Bei der Inspektion der Brauerei wurde weiter festgestellt, dass die Braugefässe mit dem Wasser des anliegenden Sees gespült worden waren. Dieses Wasser war durch das Abflusswasser eines naheliegenden Abortes verunreinigt worden. Diese Fälle wurden bakteriologisch nicht untersucht.

Eine zweite Massenerkrankung wurde im Jahre 1908 von Dr. Kling beobachtet. In der zweit Hälfte des Monats Juni erkrankten bei dem Eisenwerke Domnarfvet ungefähr gleichzeitig etwa 16 Personen mit allgemeinem Uebelbefinden, Erbrechen, Durchfall mit zahlreichen, wasserdünnen Entleerungen, Fieber bis zu 40° und Fieberschauern sowie starker Herabsetzung der Kräfte. Vidals Reaktion fiel mit B. typhi und B. paratyphi B negativ aus. Viele waren schwer krank, und vier von den Fällen endeten tödlich. Einer starb an der Gastroenteritis, die übrigen aber in Folge von Komplikationen. Zwischen mehreren der Kranken hatte keine Berührung stattgefunden. Das einzige für alle Fälle Gemeinsame war, dass sie alle kurz vor dem Erkranken Dünnbier von demselben Gebräu erhalten und genossen hatten. Der Ausbruch der Krankheit trat innerhalb der ersten 24 Stunden nach dem Genusse des Bieres ein. Auch einige aus der Familie des Brauers waren krank. Etwa zwei Monate vorher war die Frau des Brauers mit ungefähr denselben Symptonen krank gewesen. Der Darminhalt des an Gastroenteritis verstorbenen Patienten sowie die Entleerungen mehrerer Patienten wurden bakteriologisch untersucht. Eine Bakterie, die als wahrscheinliche Ursache der Gastroenteritis angesehen werden konnte, wurde nicht gefunden. Bazillen der Gruppe Paratyphus B waren nicht vorhanden.

Im Spätsommer des vorigen Jahres traten an verschiedenen Stellen in einem Kirchspiele der schwedischen Provinz Småland innerhalb einer sehr kurzen Zeit 45 unter dem Bilde des Unterleibstyphus verlaufende Krankheitsfälle auf. Auch dort konnte nichts anderes für sie Gemeinsames gefunden werden, als dass die erkrankten Personen Dünnbier desselben Gebräus eines dort wohnenden Brauers getrunken hatten. Von diesen Fällen wurden die meisten einer Untersuchung unterzogen. Unter ihnen wurde bei 33 Patienten die Vidal'sche Reaktion mit B. paratyphi B positiv gefunden. Bei 8 von ihnen wurde der Paratyphusbazillus in den Darmentleerungen und bei einem ausserdem im Harn nachgewiesen. Alle Fälle waren ziemlich leicht krank, und kein Todesfall trat ein. Das Gebräu wurde am 11.–12. August gemacht. Schon an diesen Tagen fühlte sich der Brauer krank, und am 13. war er bettlägerig. Den nächsten Tag war er aber wieder auf und fuhr mit dem zwei Tage vorher gebrauten Biere zum Verkauf aus. Den 15. musste er sich wieder zu Bette legen. Danach wurde er allmählich schlechter und starb nach ungefähr 14 Tagen. Während seiner Krankheit wurde eine Blutprobe von ihm genommen. Die mit dem Serum ausgeführte Vidal'sche Reaktion fiel stark positiv aus mit Bacillus paratyphi B.

Die Krankheit brach im allgemeinen in der ersten Woche aus, nachdem das Dünnbier getrunken war. Nur einer von den Erkrankten behauptete, dass er das Dünnbier nicht getrunken habe.

Bemerkenswert ist, dass das Dünnbier ganz frisch, ohne Lagerung, verkauft worden war. Der Brauer war auch eben kein berufsmässig Geschulter, sondern sozusagen mehr Dilettant. Beim Ausbruch der Krankheit wurden einige Reste des Bieres zusammengebracht und bakteriologisch untersucht. In diesen Proben, die damals recht stark sauer reagierten, konnten keine Paratyphusbazillen nachgewiesen werden. Trotz dieses Mangels der Beweisführung dürfte es wohl keinem Zweifel unterliegen, dass der kranke Brauer das Dünnbier infiziert hatte, das in folgedessen bei einer Anzahl Personen, die es tranken, Paratyphus hervorrief.

Ebenfalls im vorigen Jahre wurde eine Massenerkrankung bei einem schwedischen Regimente, offenbar durch den Genuss solchen Dünnbieres hervorgerufen, beobachtet. Zu einer genaueren bakteriologischen Untersuchung bot sich keine Gelegenheit. Durch die Vidal'sche Reaktion wurde aber festgestellt, dass es sich um Darmtyphus handelte.

Das Mitgeteilte illustriert, wie wichtig eine hygienische nachfolgende Behandlung erhitzter Ess- und Trinkwaren ist. Diese wird aber im Kleinbetrieb öfters vernachlässigt.

DISCUSSION.

Dr. Bolduan said it was most disquieting to learn that typhoid fever had been transmitted through "Dünnbier" and asked whether the same danger existed in ordinary lager beer. He had always felt that the latter, at least as brewed by the larger breweries, was entirely safe in this respect—safer, frequently, than water, and rather more pleasant.

Prof. Pettersson, in reply, explained that "Dünnbier" was often a home-brewed product in Sweden, and that there was little danger in "dünnbier" as brewed in the large breweries by expert brewers. He thought the previous speaker need have no fear of lager beer so brewed.

DIE BEDEUTUNG DER RINDERTUBERKULOSE FÜR DIE ENTSTEHUNG DER MENSCHLICHEN TUBERKULOSE.

Geh. Reg. Rat Dr. med. A. Weber, Direktor der bakteriologischen Abteilung des Kaiserl. Gesundheitsamtes, Berlin.

Als Robert Koch im Jahre 1908 von dem in dieser Stadt abgehaltenen Tuberkulosekongress nach Deutschland zurückkehrte, nahm er Gelegenheit, die Frage der Menschen- und Rindertuberkulose mit einigen in seiner Begleitung reisenden Kongressteilnehmern weiter zu erörtern. Pannwitz hat diese günstige Gelegenheit benutzt und aus dem von Koch auf dem Kongress gehaltenen Vortrag Schlusssätze zusammengefasst, die von Koch selbst geprüft und gutgeheissen worden sind.[1] Damit ist gleich einem teuern Vermächtnis die letzte Aeusserung Robert Kochs in dieser wichtigen Frage in authentischer Fassung uns überliefert worden, und nach dem langen, nicht immer ohne Leidenschaft geführten Kampf wirkt es versöhnend und ausgleichend, wenn in diesen Schlusssätzen mitgeteilt wird, dass Koch die gegen die Uebertragung der Perlsuchtbazillen durch Milch und Milchprodukte gerichteten Massnahmen für sehr nützlich halte, dass er sich nur dagegen wende, dass sie bei der Bekämpfung der Menschentuberkulose, auf Kosten der gegen die Verbreitung der menschlichen Tuberkelbazillen gerichteten Massnahmen, in den Vordergrund gestellt werden.

Damit ist über den Hauptplan der Tuberkulosebekämpfung Einigkeit erzielt, sie hat sich in erster Linie zu richten gegen die vom tuberkulösen Menschen drohende Gefahr, in zweiter Linie gegen die Uebertragung der Rindertuberkelbazillen auf den Menschen.

Ueber die Vorbeugungsmassregeln, die uns in Deutschland zu Gebote stehen, heisst es in der am 7. Juni 1905 vom Unterausschuss für Tuberkulose des Reichsgesundheitsrats festgestellten Fassung der praktischen Ergebnisse der neueren Forschungen über die Beziehungen zwischen der Menschen- und Tiertuberkulose [2] folgendermassen:

> "Eine gewissenhaft durchgeführte Fleischbeschau bietet einen erheblichen Schutz gegen die Uebertragung der Tuberkelbazillen mit dem Fleisch auf den Menschen; ausserdem besteht ein Schutz in der geeigneten Zubereitung des Fleisches (gründliches Durchkochen oder Durchbraten).
>
> Die Möglichkeit der Uebertragung von Tuberkelbazillen mit der Milch und den Milchprodukten auf den Menschen wird durch wirksame Bekämpfung der Tuberkulose unter dem Rindvieh erheblich verringert. Die in der Milch enthaltenen Tuberkelbazillen können durch zweckentsprechende Erhitzung abgetötet werden."

Unter dem Schutze dieser Massnahmen, deren Vervollkommnung auch noch aus anderen Gründen nur wünschens- und erstrebenswert sein kann, und die auch auf die zum Genuss für Kinder bestimmte Butter ausgedehnt werden sollten, können wir in Ruhe die Fragen erörtern und durch weitere Versuche klären, über die wir uns noch nicht ganz einig sind, insbesondere die Frage nach der Grösse der Gefahr, die dem Menschen vom tuberkulösen Rinde droht.

Niemand wird leugnen können, dass wir in dieser Frage heute viel klarer sehen als früher, und zwar Dank der Untersuchungen der letzten Jahre, die zurückzuführen sind auf die Anregungen, die Robert Koch uns zu geben nie müde geworden, und denen, wie ich mit Genugtuung hier feststellen kann, so ziemlich in allen Kulturländern Folge geleistet worden ist.

Dass die Tuberkuloseinfektion des Menschen nicht vorwiegend vom Rinde ausgehen kann, dafür spricht schon der Umstand, dass ein Zusammenhang zwischen der Häufigkeit der Tuberkulose des Rindes und des Menschen, und ein Unterschied hinsichtlich der Tuberkulosehäufigkeit zwischen solchen Ländern, in denen die Ernährung der Säuglinge und Kinder mit Kuhmilch üblich ist, und solchen, in denen aus irgendwelchen Gründen, Kuhmilch als Nahrungsmittel ausgeschlossen ist, nicht nachgewiesen werden kann.

Heymann [3] hat schon vor Jahren auf Veranlassung von Flügge einschlägige ethnographisch-statistische Beobachtungen zusammengestellt, die Japan, Groenland, die Faer-Oer Inseln, Island, die Indianer im arktischen Nordamerika, die Türkei, Rumänien, Aegypten, die Neger der Goldküste betreffen, und für die französischen Kolonien in Afrika, Amerika und Asien sind derartige Zusammenstellungen in letzter Zeit auf Veranlassung von Calmette [4] gemacht worden. In Bezug auf Italien hat Gosio auf der im April dieses Jahres in Rom stattgehabten X. Internationalen Tuberkulosekonferenz mitgeteilt, dass dort die Schwindsuchtsherde unabhängig von den Gegenden auftreten, in denen die Perlsucht endemisch ist, und dass die Perlsucht gerade dort besonders verbreitet ist, wo die Menschen von Tuberkulose verschont sind. In dieser Beziehung ist besonders die Gruppe der sogenannten "Famigli" interessant, es sind dies Landleute, die sich besonders mit der Pflege und Wartung des Rindviehs beschäftigen und durch Besorgung des Melkens, durch das Trinken ungekochter Milch, das Schlafen in den Ställen u. s w. in ununterbrochener Berührung mit dem Rindvieh stehen, welches nach Ausweis der Tuberkulinprüfung bis zu 80 Prozent perlsüchtig ist. Mehr als 1,000 dieser Famigli wurden genau auf Tuberkulose untersucht, die Schwindsucht konnte unter ihnen nur höchst selten gefunden werden, und auch bei ihren Kindern bildet die Tuberkulose eine Ausnahme.

Also die statistisch-ethnographischen Beobachtungen geben uns keinen Anhalt dafür, dass die Rindertuberkulose überhaupt eine Rolle bei der Entstehung der menschlichen Tuberkulose spielt.

Die Gesundheitsbehörden in Deutschland haben sich schon vor Jahrzehnten mit der praktisch so wichtigen Frage nach dem Beziehungen zwischen Menschen- und Rindertuberkulose beschäftigt, ohne eine Lösung zu finden. Ein Beweis dafür, dass die Rolle, welche die Rindertuberkulose für die menschliche Tuberkulose spielt, entweder so gering sein muss, dass sie in der Epidemiologie der Tuberkulose, wie es ja auch mit dem eben Gesagten in Einklang steht, nicht zum Ausdruck kommt, oder dass die Verhältnisse so verwickelt liegen, dass sie nur schwer durchschaut werden können.

Bereits im Jahre 1875 wurden auf Anregung des deutschen Veterinärrates in Preussen und Sachsen Kommissionen zur Lösung der Frage, ob der Genuss von Fleisch und

Milch perlsüchtiger Tiere für den Menschen nachteilig sei, eingesetzt, an deren Spitze Virchow bezw. Siedamgrotzky standen. Es ergab sich, ebenso wie bei Erhebungen, welche die bayerische Regierung im Jahre 1876 anordnete, kein Anhaltspunkt dafür, dass durch Milch oder Fleisch perlsüchtiger Tiere Tuberkulose auf den Menschen übertragen werden könne.

Berichte über einzelne Fälle, in denen durch den Genuss namentlich von Milch tuberkulöser Kühe Tuberkulose auf den Menschen übertragen worden sein soll, kehrten jedoch in der Literatur immer wieder. Auf wie schwachen Füssen diese Beobachtungen standen, hat Robert Koch auf der I. Internationalen Tuberkulosekonferenz in Berlin im Oktober 1902 überzeugend dargetan. Von seinem durch experimentelle Untersuchungen gestützten und gefestigten Standpunkt von der Verschiedenheit der Menschen- und Rindertuberkelbazillen ausgehend, verlangte er die einwandfreie bakteriologische Feststellung, dass es sich in solchen Fällen auch wirklich um Uebertragung der Rindertuberkulose auf den Menschen handle.

Seiner Anregung folgend wurden in Preussen, Bayern, Sachsen, Württemberg, Baden und Hessen seit dem Jahre 1905 Erhebungen über solche Fälle angestellt, in denen Menschen längere Zeit die Milch von eutertuberkulösen Kühen ungekocht getrunken hatten. Ueber das bisherige Ergebnis dieser im Kaiserlichen Gesundheitsamt bearbeiteten Sammelforschung ist von Weber[5] und Ungermann[6] berichtet worden. Unter insgesamt 111 Fällen von Genuss roher Milch oder der Milchprodukte eutertuberkulöser Kühe durch 687 Personen, von denen mindestens 280 Kinder waren, konnte nur zweimal eine Infektion mit Perlsuchtbazillen nachgewiesen werden, in 14 weiteren Fällen ergab sich der Verdacht einer bovinen Infektion.

Bei den beiden sicheren Fällen von Infektion mit bovinen Bazillen handelt es sich um Halsdrüsentuberkulose, in beiden Fällen reicht der Genuss der Milch der eutertuberkulösen Kuh bis in das Säuglingsalter zurück. In beiden Fällen lag eine sehr schwere Eutertuberkulose, die sich auf alle 4 Euterviertel erstreckte, vor, die Milch wurde, nur verdünnt mit derjenigen einer 2. Kuh, im 1. Falle 1½ Jahre, im 2. Falle 1 Jahr lang genossen, und zwar im 2. Falle noch etwa ¼ Jahr lang, nachdem die Eutererkrankung bereits bemerkt worden war. In dem einen Fall wurde die Milch nur ungekocht, im anderen gekocht und ungekocht gegeben; 8 weitere zu beiden Familien gehörige Kinder, sowie Vater und Mutter, die alle ebenfalls rohe Milch getrunken hatten, sind gesund geblieben, in beiden Familien erkrankte nur das jüngste Kind. Beide mit Perlsuchtbazillen infizierten Kinder machen jetzt einen gesunden Allgemeineindruck, weisen jedoch noch Halsdrüsenschwellung auf.

Die einzige ähnliche Forschung, allerdings bedeutend kleineren Umfanges, ist von Hess[7] in Amerika angestellt worden. Unter 18 Kindern im Alter von ½–9 Jahren, welche tuberkelbazillenhaltige Marktmilch von New York in rohem Zustande genossen hatten, konnte er im Verlaufe einer 3jährigen Beobachtung bei einem eine Halsdrüsentuberkulose nachweisen, die durch bovine Tuberkelbazillen hervorgerufen war.

Anmerkung: An der vorstehend mitgeteilten deutschen Sammelforschung hat Hess auszusetzen, dass die Tuberkelbazillen in der Milch selbst nicht nachgewiesen worden sind, er meint, dass die Eutertuberkulose nicht selten mit anderen nichttuberkulösen Erkrankungen des Euters verwechselt werde, und dass ferner nicht alle mit Eutertuberkulose behafteten Kühe Tuberkelbazillen mit der Milch ausscheiden.

Hierzu ist zu bemerken, dass die deutschen Tierärzte eine Erkrankung des Euters nur dann als tuberkulös erklären, wenn die Euterlymphdrüsen deutlich tuberkulös erkrankt sind, und dass nach den Untersuchungen von Bang [8] bei Eutertuberkulose sehr frühzeitig eine Ausscheidung von Tuberkelbazillen stattfindet, schon lange, ehe die Milch irgendwelche wahrnehmbaren Veränderungen zeigt. Ich glaube daher, zumal da es sich bei den meisten Kühen nicht nur um eine durch den Schlachtbefund festgestellte Tuberkulose des Euters, sondern in den meisten Fällen um eine schwere allgemeine, auch das Euter in Mitleidenschaft ziehende, Tuberkulose handelte, dass die Einwände von Hess nicht stichhaltig sind, obgleich ich ihm darin Recht geben muss, dass die Sammelforschung noch mehr den Wert eines Experimentes hätte, wenn es möglich gewesen wäre, die Tuberkelbazillen in der Milch selbst nachzuweisen. Aber dies hätte eigentlich auch nur dann Zweck gehabt, wenn eine solche Kontrolle sich nicht nur, wie bei den eigenen Untersuchungen von Hess auf einen Tag beschränkt, sondern sich über die ganze Zeit des Genusses der Milch erstreckt hätte. Diese Forderung ist aber gleichbedeutend mit Fallenlassen des Experimentes, denn die Verantwortung für einen derartigen Versuch am Menschen hätte nicht übernommen werden können; es musste vielmehr, so wie es in einigen Fällen auch geschehen ist, so bald die Eutertuberkulose festgestellt war, der weitere Genuss der Milch untersagt werden.

Damit ist also ein positives Ergebnis erzielt, allerdings ist der bisher nachweisbare Effekt des Genusses perlsuchtbazillenhaltiger Milch ein nur sehr geringer. Von etwa 300 Kindern der deutschen Sammelforschung und der von Hess in Amerika beobachteten Fälle erkrankten nur 3 an Halsdrüsentuberkulose. Aber wir wissen nicht, wie viele von den übrigen Kindern, sowohl von den 14 verdächtigen als auch von den ganz gesund erscheinenden auf bovinen Bazillen beruhende tuberkulöse Herde in ihrem Körper tragen, und wie sich etwa eine zurzeit noch keine Krankheitssymptome machende tuberkulöse Affektion im Laufe der Jahre weiter entwickeln wird. In der weitern Beobachtung der dem Genuss tuberkelbazillenhaltiger Milch ausgesetzt gewesenen Kinder liegt der Hauptwert der Sammelforschung. Das bisher vorliegende Ergebnis stellt erst den Beginn oder höchstens die 1. Phase der Einwirkung der bovinen Bazillen auf den menschlichen Körper dar. Nur dann, wenn es gelingen sollte, einen grossen Teil der Personen der Sammelforschung weiter zu verfolgen um womöglich durch einen Obduktionsbefund und eine genaue bakteriologische Untersuchung sich Klarheit über etwa vorhandene tuberkulöse Veränderungen zu verschaffen, wäre die Sammelforschung in der richtigen Weise wissenschaftlich verwertet. Und erst dann könnte streng genommen das Ergebnis der Sammelforschung verglichen werden mit dem Resultat, das auf dem umgekehrten Wege, nämlich durch Feststellung der bovinen Tuberkelbazillen auf Grund bakteriologischer Untersuchung an Leichenmaterial gewonnen worden ist.

Voraussetzung für die Verwendbarkeit der auf diese Weise erzielten Resultate ist natürlich die Richtigkeit der Trennung der Säugetiertuberkelbazillen in einen Typus humanus und einen Typus bovinus. Nachdem sich in dieser Beziehung namentlich bei den umfangreichen Arbeiten der amerikanischen Forscher Theobald Smith, Ravenel, Mohler, Dorset, Park und Krumwiede,[9] sowie der deutschen und der englischen Tuberkulosekommission eine solch deutliche Uebereinstimmung der Versuchsergebnisse gezeigt hat, kann diese Trennung als feststehend und allgemein anerkannt bezeichnet werden.

Eine weitere Voraussetzung ist ferner die, dass die in den menschlichen Körper aufgenommenen bovinen Bazillen sich nicht etwa im Laufe der Jahre in humane Bazillen umwandeln. Auch dafür kann, nachdem die Eber'schen Versuche, welche für die Anhänger der Umwandlungstheorie die hauptsächlichste Stütze bildeten, durch die im Kaiserlichen Gesundheitsamt in Verbindung mit Eber vorgenommene Nachprüfung[10] nicht bestätigt werden konnten, der Beweis nicht im geringsten als erbracht angesehen werden.

Halt man sich an die Tatsachen und stellt man Hypothesen und Theorien, ohne sie aus dem Auge zu verlieren, zurück, bis der Beweis für ihre Richtigkeit erbracht sein sollte, so kann man bei dem gegenwärtigen Stande unserer Kenntnisse den Nachweis von bovinen Bazillen in tuberkulösen Veränderungen des Menschen sehr wohl als Massstab für die vom tuberkulösen Rinde dem Menschen drohende Gefahr ansehen. Bei dem in neuester Zeit erbrachten Nachweis von Perlsuchtbazillen im Auswurf Lungenkranker muss man allerdings daran denken, dass auch einmal ein bovine Bazillen verstreuender Mensch als Quelle für weitere bovine Infektionen unter seinen Mitmenschen in Betracht kommen kann. Eine derartige Infektionsgelegenheit ist aber nach unseren bisherigen Erfahrungen so sehr selten, dass sie wohl praktisch vernachlässigt werden kann. Bisher ist ein Fall von Uebertragung boviner Bazillen von Mensch zu Mensch noch nicht beobachtet worden. Es dürfte sich jedoch lohnen, in Zukunft darauf zu achten und in geeigneten Fällen nach dieser Richtung hin Untersuchungen anzustellen:

Auf Typentrennung, atypische Kulturen, Umwandlungshypothese u. s. w., sowie die Uebereinstimmung der Untersuchungsergebnisse und der Anschauungen der deutschen und englischen Tuberkulosekommission sowie von Park und Krumwiede gerade in Bezug auf diese Streitfragen, kann hier im einzelnen nicht eingegangen werden. Ich verweise in dieser Beziehung auf meine im Centralbl. f. Bakt., Abt. 1, Orig. Bd. 64 (Festschr. für F. Loeffler), 1912, S. 243, veröffentlichte Arbeit.

In folgender Tabelle sind die bis jetzt vorliegenden Untersuchungen zur Feststellung der verschiedenen Typen von Tuberkelbazillen bei der Tuberkulose des Menschen zusammengestellt. Es ist die von Kossel in der 2. Auflage des Handbuchs der pathogenen Mikroorganismen von Kolle und Wassermann gegebene Tabelle ergänzt durch die in Heft 11 und 12 der Tuberkulosearbeiten aus dem Kaiserlichen Gesundheitsamt inzwischen erschienenen Arbeiten:[11]

Tabelle I.—*Feststellung der verschiedenen Typen von Tuberkelbazillen bei Tuberkulose des Menschen.*

Formen der Erkrankung.	Gesamtzahl der untersuchten Fälle.	Gezüchtet wurden Kulturen des—			Prozentzahl der Fälle mit bovinen Bazillen.	
		Typus humanus.	Typus bovinus.	Typus gallinaceus.	Personen über 16 Jahren.	Personen unter 16 Jahren.
Lungentuberkulose	[a] 811	807	5	1	0.66 (5:758)	0 (0:53)
Tuberkulose der Knochen und Gelenke	[b] 99	95	5	....	6.66 (2:30)	4.3 (3:69)
Meningitis tuberculosa	33	30	3	....	0 (0:4)	10.34 (3:29)
Generalisierte Tuberkulose	[c] 178	147	33	1	2.5 (1:40)	23.18 (32:138)
Tuberkulose Halsdrüsen	167	120	47	....	5.08 (3:59)	40.74 (44:108)
Tuberkulose der Abdominalorgane	[d] 112	78	35	1	12.28 (7:57)	51.85 (28:54)
	[e] 1,400	1,277	128	3		

[a] Darunter 2 Fälle von Mischinfektion (human und bovin) bei 2 Personen über 16 Jahren.

[b] Darunter 1 Fall von Mischinfektion (human und bovin) bei 1 Person über 16 Jahren.

[c] Darunter 4 Fälle von Mischinfektion (human und bovin) bei 4 Personen unter 16 Jahren.

[d] Darunter 2 Fälle von Mischinfektion (human und bovin) bei 2 Personen über 16 Jahren.

[e] Darunter 9 Fälle von Mischinfektion (human und bovin) bei 5 Personen über 16 Jahren und 4 Personen unter 16 Jahren.

Aus der Tabelle geht hervor, dass bis jetzt im ganzen 1,400 Fälle von Tuberkulose des Menschen auf den Tuberkelbazillentypus untersucht und genauer beschrieben worden sind, wobei, die Misch- und Doppelinfektionen mit eingerechnet, 1,277 mal Bazillen des Typus humanus, 128 mal Bazillen des Typus bovinus und 3 mal solche des Typus gallinaceus[12] nachgewiesen worden sind. Daraus, dass bei der Untersuchung von diesen 1,400 Fällen menschlicher Tuberkulose 128 mal, also in 9, 14 Prozent bovine Tuberkelbazillen gefunden worden sind, darf man nun, worauf immer wieder hingewiesen werden muss, nicht den Schluss ziehen, 9, 14 Prozent aller Fälle menschlicher Tuberkulose seien auf eine Infektion mit bovinen Bazillen zurückzuführen. Dies würde schon deswegen ein schiefes Bild geben, weil es sich zum Teil um ausgewähltes Untersuchungsmaterial handelt mit Bevorzugung derjenigen Fälle, bei denen von vornherein eine Aufnahme der Tuberkelbazillen in den menschlichen Körper vom Verdauungskanal aus anzunehmen war. Man muss vielmehr, wie dies auch in der Tabelle geschehen ist, um ein richtiges Bild zu bekommen, ausrechnen, mit welcher Prozentzahl die bovinen Infektionen bei den verschiedenen Formen menschlicher Tuberkulose beteiligt sind, und dann weiterhin den Gesichtspunkt berücksichtigen, welche Bedeutung hinsichtlich der Häufigkeit und hinsichtlich der Gutartigkeit oder Bösartigkeit des Verlaufs diesen verschiedenen Formen der Tuberkulose im Verhältnis zu der Gesamtheit der tuberkulösen Erkrankungen überhaupt zukommt.

Ferner muss, um ein richtiges Bild zu erhalten, unterschieden werden, zwischen der Tuberkulose der Erwachsenen und der Kinder. Denn, wenn auch in den letzten Jahren über weitere Fälle von Infektion Erwachsener mit bovinen Bazillen berichtet worden ist, so überwiegt dennoch die Zahl der bovinen Infektionen bei Kindern derartig, dass man die Perlsuchtinfektion nach wie vor als eine Krankheit des Kindesalters bezeichnen kann.

So sind (nach vorstehender Tabelle) bei der Tuberkulose der Abdominalorgane die Kinder mit 51.85 Prozent, die Erwachsenen mit 12.28 Prozent, bei der Halsdrüsentuberkulose die Kinder mit 40.74 Prozent, die Erwachsenen mit 5.08 Prozent, bei der generalisierten Tuberkulose die Kinder mit 23.18 Prozent, die Erwachsenen mit 2.5 Prozent, bei der Meningitis tuberculosa die Kinder mit 10.34 Prozent, die Erwachsenen mit 0 Prozent boviner Infektionen beteiligt. Bei der Tuberkulose der Knochen und Gelenke machen die bovinen Infektionen im Kindesalter 4.3 Prozent, im späteren Lebensalter 6.66 Prozent, bei der Lungentuberkulose der Erwachsenen, derjenigen Form der Tuberkulose, der im Deutschen Reich jährlich 11 mal mehr Personen als an allen übrigen Formen der Tuberkulose zusammengenommen erliegen, jedoch nur 0.66 Prozent aus.[13]

Interessant ist auch ein Vergleich, der in verschiedenen Ländern bei der Untersuchung von Halsdrüsen- und primärer Abdominaltuberkulose bei Kindern gewonnenen Zahlen, wie er in Tabelle 2 für Amerika, Deutschland und England auf Grund der Untersuchungen des städtischen Gesundheitsamtes New York, der deutschen und der englischen Tuberkulosekommission angestellt ist.

TABELLE 2.

[Park und Krumwiede.]

Formen der tuberkulösen Erkrankung im Kindesalter.	Zahl der untersuchten Fälle.	Davon waren—	
		Typus humanus.	Typus bovinus.
Städtisches Gesundheitsamt, New York:			
Halsdrüsentuberkulose	46	25	21
Primäre Abdominaltuberkulose	9	3	6
Kaiserliches Gesundheitsamt, Berlin:			
Halsdrüsentuberkulose	18	10	8
Primäre Abdominaltuberkulose	27	12	15
Englische Tuberkulosekommission:			
Halsdrüsentuberkulose	9	6	3
Primäre Abdominaltuberkulose	27	14	13

Danach besteht zwischen England und Deutschland kein wesentlicher Unterschied hinsichtlich der Häufigkeit der bovinen Infektionen, in Amerika scheinen sie namentlich bei der primären Abdominaltuberkulose—soweit bei der geringen Anzahl, der Fälle überhaupt ein Schluss berechtigt ist—prozentual etwas häufiger zu sein.

Dass in anderen Gegenden die bovine Infektion jedoch seltener ist, zeigen die Untersuchungen von Jancsó und Elfer, die unter 94 Fällen von Tuberkulose in Koloszvar, darunter 26 Personen unter 14 Jahren, nicht ein einziges Mal Tuberkelbazillen des Typus bovinus fanden. Dabei züchteten sie 25 Kulturen aus Halsdrüsen (darunter 9 Kinder unter 14 Jahren) und 25 Kulturen aus Mesenterialdrüsen (darunter 9 Kinder unter 14 Jahren). Unter den 94 Fällen befanden sich nach Angabe der Autoren, die genaue Angaben über die einzelnen Fälle leider nicht geben, allerdings nur 2, bei denen die intestinale Infektion wahrscheinlich war, und unter diesen betraf nur der eine 1 Kind von zwei Monaten. Bei dem "siebenbürgischen grauen Rindvieh," das in Koloszvar und Umgegend gehalten wird, kommt Tuberkulose äusserst selten vor, während die Tuberkulose unter den Menschen ebenso häufig ist, wie in anderen Gegenden, wo die Rindertuberkulose sehr verbreitet ist. Also einerseits ein weiteres Beispiel dafür, dass der Einfluss der Rindertuberkulose in der Epidemiologie der Tuberkulose des Menschen überhaupt nicht zum Ausdruck kommt, andererseits ein Beweis für die Richtigkeit der Typentrennung und der daraus gezogenen Schlussfolgerungen, denn, wenn in einer Gegend Rindertuberkulose nicht vorkommt, dann darf auch bei der Tuberkulose des Menschen der Typus bovinus nicht gefunden werden.

Gehen wir nun auf die Fälle boviner Infektionen etwas näher ein, so sind unter Zugrundelegung einer von mir[14] aufgestellten Berechnung ausschliesslich der Fälle von Infektion mit beiden Typen bis jetzt von boviner Tuberkulose im Kindesalter genau beschrieben 105 Fälle, und zwar sind dies 60 Fälle von Abdominaltuberkulose, 25 Fälle von Halsdrüsentuberkulose, 4 Fälle betreffend Befund von bovinen Bazillen in Tonsillen, 7 Fälle von generalisierter Tuberkulose mit unbekannter Eintrittspforte, 3 Fälle von Knochen und Gelenktuberkulose und 6 Fälle von Lupus.

Die 60 Fälle von Abdominaltuberkulose lassen sich in 3 Gruppen einteilen.

Die 1. Gruppe umfasst 34 Fälle von schwerer Mesenterialdrüsen-, Darm- und Peritonealtuberkulose, zum Teil mit daran sich anschliessender generalisierter Tuberkulose, von denen 30 tödlich verlaufen sind.

Die 2. Gruppe, 12 Fälle umfassend, weist das charakteristische Krankheitsbild: Mesenterialdrüsentuberkulose, zum Teil mit geringer Darmtuberkulose und tuberkulöse Meningitis auf. Alle 12 Fälle sind tödlich verlaufen.

Die 3. Gruppe umfasst 14 Fälle, in denen eine Mesenterialdrüsentuberkulose, in einigen wenigen Fällen gleichzeitig mit einer Darmtuberkulose geringen Grades, als Nebenbefund bei Kindern, die an anderen Krankheiten (Diphtherie, Scharlach, Masern, krupöse Pneumonie, Sepsis, perforiertes Magengeschwür) gestorben waren, erhoben wurde.

Bazillen des Typus bovinus bei Tuberkulose Erwachsener (Personen von 16 Jahren an aufwärts) sind bis jetzt ausschliesslich Doppel- und Mischinfektionen mit beiden Typen—Lupus und Tuberculosis cutis verrucosa mit eingerechnet—in 23 Fällen gefunden und genau beschreiben worden:

In 3 Fällen von Lungentuberkulose bei einem 21jährigen Schlächtergesellen, einem 31jährigen Maurer und einem 27jährigen Bauernmädchen im Lungenauswurf (Englische Kommission, H. 127 u. 128, und de Jong-Stuurman); in 1 Fall von primärer Abdominaltuberkulose und sekundärer Tuberkulose der Lungen eines 24 Jahre alten Mannes in Mesenterialdrüse und Lunge (Hoelzinger); in 1 Fall von primärer Tuberkulose der Mundschleimhaut und Halsdrüsentuberkulose einer 29 Jahre alten Frau in Halsdrüse (Weber); in 1 Fall von Kniegelenkstuberkulose einer 19jährigen Frau im Granulationsgewebe des Kniegelenks (Burckhardt); in 1 Fall von Nierentuberkulose einer 26jährigen Frau in der exstirpierten Niere (Park und Krumwiede); in 1 Fall von Peritonealtuberkulose einer 25 Jahre alten Frau im tuberkulösen Bauchfell, von dem ein Stückchen bei der Laparotomie entfernt wurde (Dammann); in 3 Fällen von isolierter Tuberkulose der Mesenterialdrüsen, die in allen 3 Fällen in Form eines einzigen verkalkten bezw. kreidig erweichten Herdes als Nebenbefund bei der Obduktion von zwei 30 und einer 20 Jahre alten Person gefunden wurde, in Mesenterialdrüse (Rabinowitsch, Henke, Marshall Fabyan); in 3 Fällen von Lupus einer 37 Jahre alten Frau bezw. 17jähriger Männer (Englische Kommission); in 2 Fällen von Hauttuberkulose bei einem 63jährigen Abdecker, bezw. einem 47jährigen Oberkuhmelker mit Tuberkulose der Cubital- bezw. Axillardrüsen in Haut, bezw. Achseldrüse (Spronck und Hoeffnagel, bezw. Niché); in 7 Fällen von Tuberculosis cutis verrucosa von Schlächtern in der Haut (Kleine, Hess).

Von besonderer Bedeutung ist die Feststellung der englischen Tuberkulosekommission, dass auch die weitverbreitetste und, weil zur Verstreuung des Krankheitskeimes führend, auch gefährlichste Form der menschlichen Tuberkulose, die Lungenschwindsucht, auf bovinen Bazillen beruhen kann. Ausser den 3 Fällen, in denen Bazillen des Typus bovinus allein im Sputum enthalten waren, sind von Kossel und Lindemann noch 2 Fälle von Phthise bei einer 27 Jahre alten Frau und einem 20 Jahre alten Mann beschrieben, bei denen eine Mischkultur beider Typen aus dem Sputum gewonnen wurde. Es ist sehr zu bedauern, dass alle 5 Patienten gestorben sind, ohne dass es möglich war, eine Obduktion vorzunehmen und auf diese Weise volle Klarheit zu schaffen. Bei der Wichtigkeit des Befundes von Perlsuchtbazillen gerade bei der Lungenphthise können wir uns mit den bisherigen Fällen nicht begnügen. Es ist vielmehr dringend wünschenswert, dass wir über solche Fälle verfügen, die durch den Obduktionsbefund und eine erschöpfende bakteriologische Untersuchung der verschiedensten Körperorgane geklärt sind.

Bemerkenswert erscheint es mir, dass es sich mit Ausnahme der Hauttuberkulose auch bei den Erwachsenen um verhältnismässig jugendliche Personen handelt. Man wird nicht fehlgehen in der Annahme, dass sie die Infektion mit bovinen Bazillen aus ihrer Kindheitszeit in das spätere Alter mit herübergenommen haben. Ueberhaupt scheint es mir, dass die Infektion mit bovinen Bazillen in der Regel noch innerhalb des Kindesalters zum Abschluss kommt, entweder durch tötlichen Ausgang oder durch Heilung; nur in seltenen Fällen dürfte sie mit in das spätere Lebensalter hinübergeschleppt werden, um dann entweder ebenfalls noch nachträglich auszuheilen oder in irgend einer Form tuberkulöser Erkrankung in die Erscheinung zu treten. Eine Infektion erwachsener Personen mit bovinen Bazillen dürfte, wenn wir von der Hauttuberkulose der Schlächter absehen, zu den grössten Seltenheiten gehören.

Wir sehen also, der Tuberkelbazillus des Typus bovinus ist imstande, so ziemlich sämtliche Formen von Tuberkulose beim Menschen hervorzurufen. Der Zahl nach bilden allerdings diejenigen Formen, die entweder mit Bestimmtheit oder mit ziemlicher Wahrscheinlichkeit als Fütterungstuberkulose aufzufassen sind—85 Fälle von Abdominal- und Halsdrüsentuberkulose—die erdrückende Mehrheit. Und auch bei den anderen Krankheitsformen—die Hauttuberkulose der Schlächter, Abdecker usw. natürlich ausgeschlossen—ist es ebenfalls nicht unmöglich, ja sogar sehr wahrscheinlich, dass die bovinen Bazillen ursprünglich im Verdauungskanal sich angesiedelt hatten.

Von 140 Fällen boviner Infektion, 117 bei Kindern und 23 bei Erwachsenen haben 56 einen tödlichen Ausgang genommen.

Noch ungünstiger gestaltet sich das Bild, wenn wir die Tuberkulose der Kinder allein betrachten und das Bild-der Abdominaltuberkulose herausgreifen, bei der von 60 Fällen 42 tödlich verlaufen sind. Angesichts dieser Tatsachen kann man nicht sagen, dass die Infektion mit bovinen Tuberkelbazillen sich durch einen besonders leichten Verlauf auszeichne.[15]

Auch Griffith [15] von der englischen Tuberkulosekommission ist dieser Ansicht, er sagt in Bezug auf die abdominale Tuberkulose bovinen Ursprungs im Kindesalter: "The disease produced by this bacillus varied in severity; in the majority of the cases it was the cause of the death of the child either from generalization or from severe local changes."

Die 3. Gruppe der Abdominaltuberkulosen andererseits zeigt, ebenso wie die Halsdrüsentuberkulose, dass die bovine Infektion auch einen gutartigen Verlauf nehmen kann.

Auf der 78. Versammlung Deutscher Naturforscher und Aerzte Stuttgart 1906[16] habe ich 17 Fälle erwähnt, bei denen die Verimpfung von verkästen, verkalkten oder verkreideten Mesenterialdrüsen, die vereinzelt oder zu mehreren beider Obduktion von anderen Krankheiten-erlegenen Kindern gefunden und dem Kaiserlichen Gesundheits amt mit der Diagnose primäre Abdominal- oder isolierte Mesenterialdrüsentuberkulose zur Untersuchung zugesandt worden waren, (trotzdem in 8 von den 17 Fällen Tuberkelbazillen im mikroskopischen Präparat zum Teil in grosser Menge nachgewiesen werden konnten) auf Meerschweinchen negativ ausgefallen war, 13 derartige Fälle ohne Tuberkelbazillenbefund im mikroskopischen Präparat wurden auch bei Erwachsenen gefunden.

Auch die englische Tuberkulosekommission[17] berichtet über 8 Fälle von Befund kalkiger Mesenterialdrüsen, die bei Verimpfung auf Meerschweinchen keine Tuberkulose hervorriefen, und bei denen auch wiederholt der direkte Kulturversuch mit dem Ausgangsmaterial negativ ausgefallen war. In den 3 Kinder betreffenden Fällen liessen sich in den Drüsen Bazillen vom Charakter der Tuberkelbazillen im mikroskopischen Präparat nachweisen, bei den 5 Erwachsenen fehlten sie.

Einzelne ähnliche Fälle sind auch noch von anderen Untersuchern mitgeteilt worden. Auffallend ist die verhältnismässig grosse Anzahl solcher Fälle, welche man doch wohl zum grossen Teil als ausgeheilte Mesenterialdrüsentuberkulose ansprechen kann. Natürlich ist es nicht möglich, nachträglich zu sagen, in welchen Fällen es sich um bovine und in welchen um humane Infektionen gehandelt hat, denn auch die letzteren können, wie wir wissen, ausheilen. Nach der Beobachtung von Jancsó und Elfer[18] ist es auch nicht ausgeschlossen, dass es sich in dem einen oder anderen Fall vielleicht um Bazillen des Typus gallinaceus gehandelt hatte.

Mit Bezug auf die Ausheilung auf bovinen Bazillen beruhender Drüsenerkrankungen besonders interessant ist der Fall H 28 der englischen Tuberkulosekommission.[19]

Am 12. Mai 1904 wurden einem 1 Jahr 2 Monate alten, von Geburt an künstlich ernährten Knaben, der Halsdrüsenschwellung beiderseits und Schwellung der linken Inguinaldrüse, die im Laufe der letzten 5 Monate entstanden waren, aufwies, 3 Halsdrüsen rechts operativ entfernt, jede von der Grösse einer kleinen Stachelbeere; zum Teil waren sie verkäst, zum Teil von gelatinöser Konsistenz, zwei enthielten im Innern eine trübe Flüssigkeit. Kurze Tuberkelbazillen in geringer Anzahl wurden im Drüsenkäse gefunden. Die direkt aus der Cervicaldrüse gezüchtete Reinkultur erwies sich als Typus bovinus. Am 1. Oktober 1904 wurde das Kind wieder untersucht; die Operationswunde war verheilt, aber das Kind sah blutarm und schlecht aus. An der linken Halsseite waren geschwollene Drüsen vorhanden, ebenso war geringe Drüsenschwellung in beiden Achselhöhlen und Leistenbeugen nachweisbar. Ausserdem schien in der Nabelgegend eine unbestimmte Resistenz zu bestehen. Das Kind litt beständig an Diarrhöe. Am 23. November 1904 hatte es sich ziemlich erholt, der Tumor in der Nabelgegend war nicht mehr zu fühlen.

Am 31. Juli 1905 sah das Kind gut genährt aus, aber die Hals- und Leistendrüsen waren grösser geworden. Auf der rechten Cornea befand sich ein kleines Geschwür. Am 17. August 1905 wurden dem nunmehr 2 Jahre 5 Monate alten Kinde 2 linksseitige, gutstachelbeergrosse Halsdrüsen mit erweichtem käsigem Inhalt exstirpiert. Im Ausstrichpräparat aus Drüsenkäse fanden sich kurze Tuberkelbazillen in mässiger Anzahl. Meerschweinchen, die mit Drüsenmaterial geimpft wurden, blieben gesund, ebenso schlug der Versuch, die Tuberkelbazillen direkt aus der Drüse zu züchten, fehl. Als der Knabe 5 Jahre alt war, wurden ihm die Inguinaldrüsen beiderseits exstirpiert. Der Gesundheitszustand war ausgezeichnet, die Lungen gesund. In der linken Leistenbeuge waren zwei, 1.8 bezw. 1.5 cm. im grössten Durchmesser betragende Drüsen, die auf dem Durchschnitt sich als aus einer trockenen, kalkig weissen, kreidigen Substanz bestehend, erwiesen, die sich leicht emulsionieren liess und dann eine milchigweisse Flüssigkeit bildete. Die Massen waren umgeben von einer dünnen fibrösen Kapsel, die hier und da Trabekeln ins Innere sandte. Ausserdem fanden sich in der linken Leistenbeuge noch 3–4, auf dem Schnitt normale Drüsen, ebenso waren die Drüsen in der rechten Leistenbeuge normal. Von den tuberkulösen linksseitigen Leistendrüsen wurden 3 verschiedene Emulsionen hergestellt, von jeder von diesen Kulturen angelegt und Tiere geimpft. Das Ausstrichpräparat einer dieser Emulsionen enthielt 4 Tuberkelbazillen, 4 Meerschweinchen, die intraperitoneal, und 2 Kaninchen, die intravenös bezw. subkutan mit Drüsenaufschwemmung geimpft waren, blieben gesund. Ebenso fiel der direkte Kulturversuch negativ aus.

Von einer der unveränderten rechten Inguinaldrüsen wurde ebenfalls eine Aufschwemmung gemacht und damit ein Meerschweinchen geimpft, aber auch dieses blieb gesund.

Es handelte sich also um einen Fall generalisierter Drüsentuberkulose beruhend auf Bazillen des Typus bovinus, der Tendenz zur Heilung zeigte, und bei dem der tuberkulöse Prozess in einigen Drüsensystemen auch zur Ausheilung gekommen war.

In Verbindung mit diesem Fall verdient Erwähnung ein interessanter Befund von Ungermann [20] der in vollkommen unveränderten Cervical, Bronchial- und Mesenterialdrüsen eines 3¾ Jahre alten Knaben, der auch sonst keinerlei Zeichen von Tuberkulose darbot, Bazillen des Typus bovinus nachweisen konnte.

Findet sich nun innerhalb derselben Gruppe tuberkulöser Erkrankungen etwa im Krankheitsverlauf oder im pathologisch-anatomischen Bilde irgend ein Unterschied, der in einem gegebinen Fall vielleicht schon einen Schluss auf eine Infektion mit bovinen oder humanen Bazillen erlaubte? Dies ist, wie auch die englische Kommission betont, nicht der Fall. Es bedarf vielmehr in jedem einzelnen Falle erst der bakteriologischen Unterscuhung, um festzustellen, welchem Typus die Tuberkelbazillen angehören.

Und doch scheinen sich bei genauerer Vergleichung der auf humanen Bazillen einerseits und der auf bovinen andererseits beruhenden Fälle derselben Gruppe tuberkulöser Erkrankungen geringe Unterschiede zu ergeben. So konnte Stanley Griffith durch sorgfältige Gegenüberstellung von je 14 auf bovinen und auf humanen Tuberkelbazillen beruhenden Fällen von primärer Abdominaltuberkulose der englischen Tuberkulosekommission, wie es in der anbei wiedergegebenen Tabelle von Griffith[21] geschehen ist, nachweisen, dass bei den auf humanen Tuberkelbazillen beruhenden Fällen die generalisierte Tuberkulose eine schwerere und weitverbreitetere war als bei den Fällen boviner Infektion. Bei den Fällen von boviner Infektion findet sich 19 mal, bei den Fällen von humaner Infektion dagegen 39 mal, die Angabe "Schwere Erkrankung" in den der Eintrittspforte ferner liegenden Organen und Drüsen.

TABLE 3.—*Charts showing extent and distribution of disease in cases of tuberculosis in children primary in the alimentary tract, due* (*a*) *to bovine tubercle bacilli,* (*b*) *to human tubercle bacilli.*

VIRUSES VIRULENT FOR BOVINES AND RABBITS (GROUP I).

[∗ denotes severe disease. + denotes slight disease. ○ denotes "no tuberculosis."]

No. of virus.	Age of child.	Cause of death.	Intestines.	Cervical glands.	Mesenteric glands.	Lungs.	Bronchial glands.	Spleen.	Liver.	Kidneys.	Meninges.	Serous surfaces.	
												Peritoneum.	Pleura.
H. 7. "C.M."	3 years	Tuberculosis	[a]+	....	∗	∗	○	∗	+	+	∗	+	....
H. 10. "B.S."	$1\frac{9}{12}$ years	Peritonitis (?), tuberculous.	○	○	∗	○	+	○	○	○	○	+	○
H. 14. "F. S."	$4\frac{1}{2}$ years	Tuberculosis	∗	....	∗	∗	(b)	∗	+	+	....	∗	....
H. 19. "S. W."	$2\frac{9}{12}$ years	do	○	....	∗	+	○	∗	+	+	∗	○	(c)
H. 20. "F. L."	$2\frac{10}{12}$ years	do	∗	....	∗	○	○	+	○	○	....	∗	....
H. 32. "Y. W."	$2\frac{9}{12}$ years	do	∗	....	∗	∗	+	∗	+	○	○	+	....
H. 38. "J.M."	$1\frac{3}{12}$ years	Broncho-pneumonia	∗	∗	∗	○	○	....	....	....	....	∗	....
H. 59. "L.B."	$2\frac{3}{4}$ years	Tuberculosis	∗	+	∗	∗	(d)	○	○	+	+	○	....
H. 64. "M.G."	$4\frac{9}{12}$ years	do	○	....	+	∗	○	○	+	∗	∗	○	....
H. 65. "K.B."	$1\frac{1}{2}$ years	Whooping cough (?)	∗	....	∗	○	○	(?)	○	○	○	○	....
H. 69. "F.K."	2 years	Tuberculosis	+	○	+	○	○	○	○	○	∗	+	○
H. 77. "R.L."	$1\frac{1}{12}$ years	do	∗	....	∗	○	○	○	○	○	○	∗	....
H. 88. "E.L."	$8\frac{7}{12}$ years	do	∗	....	∗	○	+	○	(?)	○	○	○	....
H. 89. "W.I."	4 years	do	∗	....	∗	∗	(d)	○	○	+	○	+	....

VIRUSES SLIGHTLY VIRULENT FOR BOVINES AND RABBITS (GROUP II).

No. of virus.	Age of child.	Cause of death.	Intestines.	Cervical glands.	Mesenteric glands.	Lungs.	Bronchial glands.	Spleen.	Liver.	Kidneys.	Meninges.	Serous surfaces.	
												Peritoneum.	Pleura.
H. 6. "U.H."	3 years	Tuberculosis	∗	....	∗	+	∗	....	∗	+	....	∗	....
H. 8. "S.C."	11 months	do	[a]+	(b)	∗	∗	....	∗	∗	∗	....	....	[e]∗
H. 18. "T.T."	$2\frac{5}{12}$ years	do	∗	....	∗	∗	∗	+	+	+	....	∗	....
H. 30. "E.M."	$3\frac{10}{12}$ years	do	∗	(b)	∗	(?)	∗	○	○	○	○	(?)	....
H. 36. "M.D."	$4\frac{1}{2}$ years	do	∗	....	∗	+	∗	+	○	○	∗	○	∗
H. 55. "R. D."	$2\frac{8}{12}$ years	Broncho-pnuemonia	+	+	+	○	+	+	○	○	....	....	....
H. 57. "B.J."	1 year	Tuberculosis	∗	∗	∗	∗	+	○	+	+	(?)	○	....
H. 63. "G.R."	7 months	Tuberculosis and mitral stenosis.	∗	∗	∗	∗	∗	+	+	+	∗	○	(f)
H. 70. "N.W."	10 months	Tuberculosis	∗	....	∗	∗	∗	∗	∗	+	∗	+	....
H. 74. "D.S."	7 months	do	(g)	....	∗	+	∗	∗	∗	+	∗	○	....
H. 75. "A.H."	7 years	do	+	....	+	+	∗	○	○	○	○	∗	....
H. 78. "O.D."	9 months	Tuberculosis and broncho-pneumonia.	○	∗	○	∗	∗	∗	+	+	∗	○	....
H. 82. "G.F."	4 years	Pleurisy and pericarditis.	○	+	+	+	∗	+	○	○	....	○	....
H. 83. "G.C."	$1\frac{8}{12}$ years	Tuberculosis	○	+	+	∗	∗	∗	+	+	∗	○	....

[a] One ulcer.
[b] Enlarged.
[c] Slight adhesions.
[d] Slightly enlarged.
[e] Pericardium.
[f] Adherent.
[g] One doubtful ulcer.

Sehr bemerkenswert ist ferner der Unterschied im Verhalten der Bronchialdrüsen, auf den Griffith aufmerksam macht *hier* findet sich bei der Infektion mit humanen Bazillen 11 mal die Angabe "Schwere Erkrankung," bei der Infektion mit bovinen dagegen o mal. Umgekehrt ist bei der Infektion mit bovinen Bazillen 8 mal vermerkt "Keine Tuberkulose," während bei der humanen Infektion in allen 13 untersuchten Fällen eine Tuberkulose der Bronchialdrüsen vorhanden war.

Ferner ergab sich ein Unterschied hinsichtlich des durchschnittlichen Lebensalters der der humanen bezw. der bovinen Infektion erlegenen Kinder. Für die ersteren Fälle beträgt das Durchschnittsalter 2, 4 Jahre; für die letzteren Fälle 3, 3 Jahre.

Diese interessanten Feststellungen von Griffith sprechen dafür, dass der Bazillus des Typus bovinus für den Menschen weniger virulent ist als der des Typus humanus, eine Ansicht, welche auch die englische Kommission[22] in ihren Schlusssätzen vertritt, wenn sie vom Typus humanus sagt, "to which he (man) is seemingly most prone," und zu der sich auch Calmette auf dem Tuberculosecongress in Rom im September 1911 bekannt hat, indem er von den bovinen Bazillen gesagt hat: "Ils sont peu virulents pour l'espèce humaine, mais il semble, qu'absorbés fréquemment ou à des doses massives, ils soient, dans certains cas, susceptibles d'infecter l'homme, surtout dans le jeune âge." Jedenfalls geben sie keine Stütze ab für die gegenteilige namentlich von v. Behring verfochtene Ansicht, der Typus bovinus müsse, da er für alle Versuchstiere einschliesslich der anthropoiden Affen virulenter sei als der humane, auch für den Menschen eine höhere Virulenz zeigen. Im übrigen stimmt die Voraussetzung dieses Deduktionsschlusses gar nicht, denn, wie die Untersuchungen der englischen Kommission übereinstimmend mit denjenigen von v. Dungern und Smidt ergeben haben, ist der bovine Bazillus für Affen und insbesondere für menschenähnliche Affen gar nicht virulenter als der humane Bazillus:

Die zahlreichsten Versuche an Affen sind von der englischen Tuberkulosekommission angestellt worden. Auf Grund ihrer Versuche rechnet diese Kommission das Meerschweinchen, die Affen und den Schimpansen in die "Susceptible Group," d. h. zu denjenigen Tieren, die für beide Typen empfänglich sind. Während sie jedoch beim Meerschweinchen die schon bekannte Tatsache bestätigen konnte, dass die bovinen Bazillen für dieses Tier virulenter sind, als die humanen—von je 10 mit je 1 mg Reinkultur subkuten geimpften Meerschweinchen hatten die bovinen eine durchschnittliche Lebensdauer von 56, 5 Tagen, die humanen von 86, 5 Tagen—kommt sie bei den Affen (Rhesus) und den Schimpansen zu dem Schluss, dass für diese Tiere beide Typen von Tuberkelbazillen in gleichem Grade virulent sind.

Der Schluss, den A. Stanley Griffith[23] aus diesen Versuchen zieht, lautet:

"The disease produced by the human tubercle bacilli was equal in severity to that produced by the bovine tubercle bacilli of human origin, and no difference was observed either in the naked-eye characters of the disease or in the distribution of the lesions.

"The results obtained with the human tubercle bacillus are identical also with those obtained with cultures raised directly from bovine tuberculous lesions. * * *

"The experiments show therefore that the human tubercle bacillus is as virulent for the rhesus monkey as the bovine tubercle bacillus."

Und vom Schimpansen, der ja dem Menschen besonders nahe steht, heisst es (ibid., p. 44): "The chimpanzee, like the rhesus monkey, is therefore very susceptible both to the human and to the bovine tubercle bacillus, an extremely small dose of either kind of bacillus being capable of producing rapidly fatal general tuberculosis. The experiments do not bring out any difference in the virulence for the chimpanzee of the two kinds of tubercle bacilli."

Die mit den humanen Bazillen subkutan geimpften Schimpansen gingen sogar etwas früher ein als die mit den entsprechenden Dosen boviner Bazillen geimpften.

Auch die Fütterungsexperimente an Affen, über die schon im Second Interim Report, Part II, Vol. II, p. 1164, berichtet worden ist, hatten dasselbe Ergebnis, denn Cobbett sagt dort: "The feeding experiments do not support the opinion that bacilli of Group I (Typus bovinus) are more virulent for the monkey than those of Group II (Typus humanus)," und weiter: "There is therefore no evidence that one kind of bacillus is more virulent than the other for the chimpanzee; both are capable in small doses either by feeding or subcutaneous injection of causing acute general tuberculosis."

Hiermit stimmen überein die Ergebnisse der von v. Dungern und Smidt[24] an anderen menschenähnlichen Affen, an Gibbons (Hylobates) mit pekuniärer Unterstützung der Deutschen Reichsverwaltung auf Sumatra ausgeführten Versuche. Auch beim Hylobates ergab sich bei der subkutanen Verimpfung von 0.01 g Reinkultur keinerlei Unterschied zwischen der Wirkung der humanen und bovinen Bazillen sowohl was die Lebensdauer der Tiere als auch was den pathologisch-anatomischen Befund betrifft; 8 mit 0.01 g je 2 verschiedener Stämme des Typus humanus und bovinus geimpfte Tiere gingen sämtlich innerhalb 35 bis 65 Tagen ein.

Auch bei der Verfütterung zeigten humane und bovine Bazillen für den Gibbon gleiche Virulenz. Bei dieser Infektionsart war jedoch das pathologisch-anatomische Bild verschieden. Die zwei durch Fütterung mit bovinen Bazillen infizierten Tiere wiesen Darmgeschwüre und verkäste Mesenterialdrüsen auf, während die Bronchialdrüsen frei waren; bei den beiden durch Fütterung mit humanen Bazillen infizierten Tieren waren dagegen Darm und Mesenterialdrüsen frei, während die Bronchialdrüsen verkäst waren und auch primäre Lungenherde bestanden. Die Verfasser sind der Ansicht, dass die beiden Bazillentypen nicht in gleicher Weise an die Infektionspforten angepasst sind.

Viele Wandlungen hat bereits die Tuberkuloseforschung durchgemacht, und auch die in den letzten Jahren in noch nie dagewesenem Umfang und mit ganz aussergewöhnlichem Eifer durchgeführten Untersuchungen haben eine vollständige Klärung der schwebenden Fragen noch nicht herbeizuführen vermocht.

Manches bleibt noch zu tun übrig. Die von der englischen Kommission bei Lupus und Pferdetuberkulose gefundenen abgeschwächten Tuberkelbazillen bedürfen noch der Klärung, auch die bisher vorliegenden Fälle von Befund boviner Bazillen bei Lungenphthise des Menschen sind mangels von Obduktionsbefunden noch unvollständig.

Aber einen guten Schritt vorwärts sind wir in den letzten Jahren gekommen und auf Grund dieses Fortschrittes können wir die

Frage, welche Bedeutung der Rindertuberkulose für die Entstehung der menschlichen Tuberkulose zukommt, heute dahin beantworten:

Die Rindertuberkulose bedeutet, vom Standpunkte des Einzelindividuums aus betrachtet, für die menschliche Gesundheit eine nicht zu unterschätzende Gefahr, insofern als sie, auf den Menschen übertragen, im Kindesalter eine meist unter dem Bilde der Fütterungsinfektion verlaufende, gar nicht so selten, entweder durch Generalisation des Krankheitsprozesses oder durch schwere lokale Veränderungen zum Tode führende Tuberkulose hervorzurufen imstande ist, und ausserdem, in allerdings sehr seltenen Fällen, unter dem Bilde so ziemlich jeder anderen Form tuberkulöser Erkrankung bei Kindern und Erwachsenen in Erscheinung treten kann.

Zum Schutze des Einzelindividuums sind daher Massnahmen gegen die vom tuberkulösen Rinde drohende Gefahr nicht zu entbehren.

Ein anderer Masstab ist jedoch in der Beurteilung der Frage anzulegen, sobald es sich nicht um das Einzelindividium und die zum Schutze seiner Gesundheit erforderlichen Massnahmen, sondern um ganze Völker und die Bekämpfung der diese bedrohenden Volksseuchen handelt.

In der Epidemiologie der Tuberkulose als Volkskrankheit, von der uns ethnographisch-statistische Beobachtungen und Untersuchungen ein Bild geben, kommt die Rolle, welche die Rindertuberkulose für die Entstehung der Tuberkulose des Menschen spielt, überhaupt nicht zum Ausdruck, sie tritt gegenüber der Bedeutung, welche dem tuberkulösen Menschen als der gefährlichsten Infektionsquelle zukommt, vollkommen in den Hintergrund.

Beim tuberkulösen Menschen hat also die Bekämpfung der Tuberkulose als Volkskrankheit, wenn sie einen in die Augen springenden Erfolg haben soll, einzusetzen.

Von diesem Standpunkt aus betrachtete Robert Koch, der siegreiche Feldherr im Kampfe gegen die verheerenden Volksseuchen, die ganze Frage und in dieser Beziehung hat er bis auf den heutigen Tag Recht behalten.

Bovine tuberculosis presents, in so far as the individual is concerned, a danger to human health which must not be minimized. When it affects human beings, it usually takes the form of an alimentary infection in children, and is not infrequently capable of producing a tuberculosis which, either by a generalization of the disease processes or as the result of severe local changes, leads to death. Further, in very rare cases, it may appear in the form of practically every other type of tubercular affection in children and adults.

For the protection of the individual, therefore, precautions must not be neglected against the dangers presented by tuberculous cattle.

A different attitude, however, must be assumed in dealing with the question, when the protective arrangements are directed, not toward the individual and the necessary measures for the preservation of his health, but toward the race and the combatting of this national scourge.

The epidemiology of tuberculosis as a national disease, which is based on the results of ethnographic-statistical observations and researches, shows that bovine tuberculosis does not play an appreciable part in the production of tuberculosis in man in comparison with the significance of the tuberculous human being as the most dangerous source of infection.

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[1] Tuberkulosis 1908 und Berliner klin. Wochenschr., 1908, Nr. 44.

[2] Tuberkulosearbeiten a. d. Kais. Gesundheitsamt, 1905, Heft 6, und Deutsch. mediz. Wochenschr., 1905, Nr. 40.

[3] Heymann. Statistische und ethnographische Beiträge zur Frage über die Beziehungen zwischen Säuglingsernährung und Lungenschwindsucht. Zeitschr. f. Hygiene u. Infektionskrankh., Bd. 48, 1904, S. 45, u. Weitere Beiträge zur Frage über die Beziehungen zwischen Säuglingsernährung und Tuberkulose, Bd. 60, 1908, S. 424.

[4] Calmette. Enquête sur l'épidémiologie de la tuberculose dans les colonies françaises. Annales de l'Institut Pasteur, 1912, No. 7, p. 497.

[5] Tuberkulose- Arb. a. d. Kais. Gesundheitsamt, Heft 10, 1910, S. 1.

[6] *Ibid.*, Heft 12, 1912, S. 213.

[7] Hess. The subsequent health of children who drank milk containing tubercle bacilli. Jour. of Amer. Med. Association, Vol. LVI, 1911, p. 1322.

[8] Bang. Deutsche Zeitschr. f. Tiermedizin, Bd. 11, 1885, S. 45.

[9] Park and Krumwiede. The relative importance of the bovine and human types of tubercle bacilli in the different forms of human tuberculosis. Jour. of Medical Research, vol. 23, 1910, and vol. 25, 1911.

[10] Neufeld, Dold und Lindemann. Ueber Passageversuche mit menschlischem Tuberkulosematerial nach der Methode von Eber. Centralbl. f. Bakt., Abt. 1, Orig. Bd., 1912.

[11] Steffenhagen. Vergleichende bakteriologische Untersuchungen über Tuberkelbazillen verschiedener Herkunft, Heft 11.

Steffenhagen. Ueber Säuglingstuberkulose. *Ibid.*

Weber und Dieterlen. Untersuchungen über den Typus der im Auswurf Lungenkranker vorkommenden Tuberkelbazillen. Virulenzprüfung von mittels der Antiforminmethode gezüchteten Tuberkelbazillen, Tb. Heft 12.

Lindemann. Untersuchungen über den Typus der im Auswurf Lungenkranker vorkommenden Tuberkelbazillen. *Ibid.*

[12] Auf diese 3 Fälle: Loewenstein (Auswurf eines Schwindsüchtigen), Koch und Rabinowitsch (Milz eines an Miliartuberkulose gestorbenen Mannes), Jancsó u. Elfer (Mesenterialdrüse eines 8 jährigen Mädchens) soll hier nicht näher eingegangen werden. Die wenigen bisher vorliegenden Fälle gestatten noch keinen Schluss auf die Bedeutung der Hühnertuberkelbazillen für die menschliche Gesundheit zu ziehen, zumal da die Frage einer etwa vorliegenden Mischinfektion nicht genügend berücksichtigt ist.

[13] Folgende Korrecturfaline.

[14] Centralbl. f. Bakt., Abt. I, Orig. Bd. 64, 1912, S. 263.

[15] A. Stanley Griffith, Investigation of viruses obtained from cases of human tuberculosis (other than Lupus). Final Report of the Royal Commission on Tuberculosis (human and bovine), Part II, Appendix, Vol. I, p. 55.

[16] Weber, Die Infektion des Menschen mit den Tuberkelbazillen des Rindes (Perlsuchtbazillen). Deutsche med. Wochenschr., 1906, Nr. 49, und Weber und Taue, Weitere Untersuchungen über Tuberkelbazillen verschiedener Herkunft mit besonderer Berücksichtigung der primären Darm- und Mesenterialdrüsentuberkulose. Tuberkulose-Arb. a. d. Kais. Gesundheitsamt, Heft 6, 1907, S. 15.

[17] Cobbett, The pathogenic effects of human viruses. Second Inter. Report, Part II, Appendix, Vol. II, p. 17, und A. Stanley Griffith, Investigation of viruses obtained from cases of human tuberculosis (other than Lupus). Final Report, Part II, Appendix, Vol. I, p. 12 u. 18.

[18] Jancsó und Elfer, Vergleichende Untersuchungen mit den praktisch wichtigeren säurefesten Bazillen. Beiträge zur Klinik der Tuberkulose, Bd. 18, 1911, S. 175.

[19] Final Report, Part II, Appendix, Vol. I, p. 108 f.

[20] Ungermann, Untersuchungen über die tuberkulöse Infektion der Lymphdrüsen im Kindesalter. Tuberkulose-Arbeiten a. d. Kais. Gesundheitsamt, Heft 12, 1912, S. 109.

[21] Final Report of the Royal Commission, Part II, Appendix, Vol. I, p. 19.

[22] Final Report, p. 38.

[23] Final report, Part II, Appendix, Vol. I, p. 43.

[24] V. Dungern und Smidt, Ueber die Wirkung der Tuberkulosebazillenstämme des Menschen und des Rindes auf anthropoide Affen. Arb. a. d. Kais. Gesundheitsamt, Bd. 23, 1906, S. 570.

THE RELATION OF BOVINE TUBERCULOSIS TO HUMAN TUBERCULOSIS.

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In the history of any advance in medicine we may usually trace three or four distinct phases. First we have a series of isolated observations and, one might almost say, visions arising out of them. Then comes the mind with a grasp which, noting and collecting these observations, makes itself master of the whole question and presents to the world the true inwardness of what, hitherto, has been hinted at, and that but vaguely. Then come the patient workers who analyze, dissect, test, and correct, and, finally, after much sifting of wheat from chaff, present a rounded-off and acceptable working plan.

At present, as regards tuberculosis, men are working through the third phase, or are even entering the stage at which Koch's great work, modified and corrected perhaps, not only by himself but by others, is being accepted and acted upon. Nothing is more interesting, however, than to note the evolutionary changes that have occurred in the opinions of almost all who have taken up the study of the tubercle bacillus and its relation to tuberculosis. Koch and the German school, no less than Arloing and Calmette of the French school, and English and American workers, all, from time to time, seem to have modified their opinions on some of the great questions involved in the study of tuberculosis as they have come to give it greater care and closer attention.

As I have pointed out elsewhere, the late Prof. Koch stated in New York that what appeared to be keenly opposed schools of thought were gradually coming nearer, and even into line with, one another; what might be called the British view was coming nearer what is held in Germany; whilst, on the other hand, what might be accepted as the German view, was approximating more closely to British experience. This dictum has now received almost universal acceptance, and nothing has been more striking than the altered points of view that the study of different conditions and wider experience have brought about, and the modification of opinions on the modes of infection that has been the outcome of these alterations in points of view. The profound study given to tuberculosis by multitudes of observers, groups of these observers working in cooperation, has demonstrated most clearly that tuberculosis is a disease highly protean in character. The study of a few cases, however careful and accurate that study may be, can give but a part of the information required in order that the disease as a whole may be understood. Any generalization formed without an enormous experience of the different types of the disease must necessarily be incomplete and even inaccurate. Take the question of the conveyance of infection by the alimentary canal, for example. Are the opinions held to-day those that were in vogue three or four years ago even amongst those actually engaged on the study of intestinal infection? Or, again, can those who have studied the facts concerning bovine and human infection in tuberculosis maintain the same attitude as regards the different forms of tuberculosis that they held 10 years ago? Have not the experiments devised and carried out to determine whether we were dealing with modified, bovine, or human bacilli or with mixed bacilli of these two types rendered it necessary for us to review our ideas and conceptions concerning the question of modification of type both as regards morphology and virulence?

Those who study the records of the British Royal Commission will find that the commissioners were unwilling to commit themselves, on the one hand, to any hypothesis of such modification or, on the other, to any hypothesis as to mixtures of types of bacilli, until the very end of their investigation, when they could utilize the results of their eight or nine years' experiments, observations, and experience. Even at the last, although they were able to obtain scarcely a fragment of experimental evidence in favor of modification, and although they were able to prove that many of what might, in the first instance, have been looked upon as typical tubercle bacilli were really mixtures of different types, they still felt justified (in view of the amount of indirect evidence of modification to be gathered from the study of the bacilli separated from cases of tuberculous lupus and from cases of equine tuberculosis) in looking forward to, and even devising, further experiments and new methods of determining whether evidence of such modification does or does not exist.

There seems to be, may I here point out, a feeling on the part of some of those who have followed the work of the German and the British commissions on tuberculosis that, as the commissions have arrived at somewhat different conclusions, the results of their experiments must have been equally divergent. This, however, is to my mind a misconception of the true state of affairs, for those who have taken the trouble to follow in detail the work of the two commissions can not but be impressed by the marked similarity of the results obtained. There appears to be scarcely an observation made by one commission that has not been made at some time or other by its fellow. Please do not misunderstand me. I do not maintain that the same observations have been made with equal frequency, or that the same conclusions have been drawn from these observations; that would be too much to expect from men differing in mental constitution, outlook, and experience, and placed, moreover, in different surroundings. Their conclusions could never be the same, should the observations differ ever so slightly, but they are sufficiently in accord to compel us to realize that where differences do occur some local or other condition must be found for their explanation.

For my own part, I believe that even in different parts of Great Britain tuberculosis differs in type, and that bovine and human tuberculoses manifest themselves in different proportion, and even in different fashion, say, in Edinburgh, and in London, in Manchester, and in Cambridge; and I am satisfied that, if in a small country like ours there are these local variations, they may also be demonstrated in other countries covering greater areas.

All observers agree that cases of pulmonary tuberculosis are, as a rule, but the result of direct infection from individual to individual with the "human type" of tubercle bacillus. How are we to explain the statement made at the last Congress on Tuberculosis, at Rome, that although the investigators of the British Royal Commission succeeded in isolating bovine tubercle bacilli from the ordinary sputa of 2 out of 28 cases of pulmonary phthisis, systematically and carefully examined, with all possible precaution, only some two or three such cases of infection are recorded among nearly 800 similar cases examined in Germany, France, the United States, and elsewhere? It surely can not be merely a question of technique. Again, how is it that in London such a comparatively small number of cases of bone tuberculosis, in which bovine bacilli can be demonstrated, were collected by the Royal Commission; whilst in Edinburgh, all observations, from those first made by me in the eighties of the last century, down to those recently made by Stiles, Ritchie, Fraser, Mitchell, Miller, and others, point to a much larger proportion of cases of bone tuberculosis in which bovine infection appears to play the important etiological part?

While agreeing that it would be folly to accept all tuberculosis of the alimentary canal as resulting from bovine infection, it can undoubtedly be demonstrated that a considerable proportion of cases of tuberculosis of the alimentary canal and of the adjacent lymphatic glands come into being as the result of such infection. Dr. Scurfield, of Sheffield, maintains, with a certain show of reason, that tuberculosis of the alimentary canal in children may be contracted from infective material contained in the filth collecting on floors, furniture, and the like. Further, it has to be remembered that in the very class of children in which alimentary tuberculosis is most rife a comparatively small amount of milk is consumed, and we know that in most cases what may be called massive infection is essential for the production of tuberculosis of the alimentary tract in healthy children, the amount of infective material necessary to set up the disease diminishing with the increase of facilities for entrance of the bacilli resulting from malnutrition and from inflammatory and other lesions of the mucous membrane. In spite of all this, the very great amount of experimental evidence now at our disposal having been carefully worked over, it appears to me that the only difference of opinion that continues in regard to this matter is as to the proportion and exact nature of the cases of bovine tuberculosis that may occur at different ages and in different positions in the human subject; there can be no doubt that such infection does take place, that it occurs especially in the early years of life, and that it may affect, not only the alimentary tract with its associated glands, but also the bones, and even the lungs. There are, of course, differences, and very great differences, of opinion as to the relative importance and the amount of infection under these different conditions, and in these various positions, but the fundamental fact is accepted by all.

Delépine, in his address at the Fourth Annual Conference of the National Association for the Prevention of Consumption, in 1912, insists that many workers approaching this matter from different standpoints have shown very conclusively "that bovine tuberculosis must be considered a source of danger to man and more especially to infants." He goes on to say that "several observers," especially the Royal Commission on Tuberculosis, "believe that there are essential differences between human and bovine tuberculosis, but they admit that man is liable to both forms of the disease." Much of the evidence bearing on the question of identity and reciprocal infection has been based on clinical, anatomical, morphological, and physiological observations, and on general experimental work. Fragmentary statistical evidence has also been brought forward, but nothing so complete or convincing as that supplied by Muller, in Germany, and Newsholme and Delépine in this country. Many years ago, I collected a number of statistics from the Sick Children's Hospital, Edinburgh, as to the post-mortem findings in tuberculous children. These have been included in a series brought together by Dr. Bovaird, of New York, who refers to 1,161 post-mortem examination of tuberculous children, among which he found 236, or 2.03 per cent, suffering from primary intestinal tuberculosis, figures that correspond fairly closely with mine published in 1887.

In the early days of the history of the tubercle bacillus, no distinction, as regards their capacity to infect man and animals, was made between the bacillus of bovine origin and that derived from the human subject. Even Koch made no such distinction, and when "human" bacilli were found in the milk of cattle, they were at once accepted as the cause of much of the glandular abdominal and bone tuberculosis met with in children, and even of some of the tuberculosis met with in adults. Within a couple of years after Koch's great demonstration, however, E. Klein announced that he had been able to make out certain well-marked features by which he could distinguish the human tubercle bacillus from the bovine type. He laid special stress upon the morphology of the organisms in this connection, and also upon their power of growth at different temperatures. Here the matter rested for at least a dozen years, and it was generally accepted that even if the two types of bacilli were not identical, both were able to produce tuberculosis in bovines and in the human subject. Then, however, Dinwiddie, among the veterinarians, and Theobald Smith, from the human side, again challenged the holders of the hypothesis of identity, and were supported, somewhat half-heartedly, no doubt, by several writers, but it was not until 1901 that Koch, assisted by Schultz, set the heather ablaze.

What are the possible sources of infection by the bovine types of tubercle bacillus? A most important question in regard to the infectivity of the milk and feces of naturally infected tuberculous cows—cows that had contracted the disease in the ordinary way—is answered by the experiments conducted with great care and precision by Dr. F. Griffith. It has been generally accepted that the milk from cows in which the udder is manifestly tuberculous contains tubercle bacilli, but there still was considerable difference of opinion as to the amount of danger, if any, that attaches to the milk of tuberculous cows in which the udder presents no evidence of disease, especially in cases in which such obvious symptoms of tuberculosis as emaciation and cough are present, and in those in which these conditions are absent, and in which the disease can be recognized during life only by means of the "tuberculin test."

Only six cows were examined for the commission, but these were submitted to the most minute investigation. None of them showed any disease of the udder during life, and after slaughtering, although careful search was made for tuberculous lesions and tubercle bacilli in the udder, none were found, except in one case, in which one-quarter of the udder showed four small nodules that could not possibly have been detected in the living animal.

In three of the animals, including the above-mentioned cow, clinical symptoms of tuberculosis were present, and in the milk tubercle bacilli could readily be found. In the other three, in which the disease could be diagnosed only by tuberculin, no effective tubercle bacilli were found.

Whether the fæces of tuberculous cows are infective or not is a matter of no small moment; indeed, much importance has been ascribed to it by American writers. "Dirt" of various kinds, some of it undoubtedly coming from the cows within the sheds in which the milking is done, is almost constantly present in milk as it reaches the consumer. Certainly, the evidence collected by the commission appears to show that cows, suffering from extensive tuberculosis of the lungs, in the act of coughing displace and discharge numbers of bacilli from the air spaces and passages into the pharynx, and, the sputum being swallowed, the contained bacilli pass into the stomach and intestine. These bacilli, alive or dead, appear in the feces, whence they may infect both human and bovine animals.

It has been demonstrated that, injected subcutaneously, into calves, in doses of 50 milligrams of culture under three weeks old, the "human" tubercle bacillus rarely produces progressive tuberculosis, and the animal remains in fairly good health. At the seat of inoculation there is usually a larger or smaller local lesion, which ultimately becomes firm and fibrous, and often contains a cyst. A few caseous or calcareous nodules may be met with in the glands nearest the seat of inoculation, or in one or several of the internal organs; but these may all be looked upon as strictly localized and retrogressive tuberculous lesions. In only about 50 per cent of the animals inoculated was the extension beyond the nearest glands.

Of the bovine bacillus, a dose of 50 milligrams of a 3-weeks-old culture, injected subcutaneously into the neck of a calf, produces generalized tuberculosis, which usually proves fatal within eight weeks. At the point of injection is a caseous infiltrating mass which may become a regular abscess. The neighboring lymphatic glands become enlarged and caseous, while the more distant glands are also affected, and often caseous, though to a less extent. Most of the important viscera and serous membranes of the body cavities are usually studded with tubercles, which are often caseous.

The human bacillus, slightly virulent for the calf, is also but slightly virulent for rabbits, and, in carrying out investigations as to the type of bacillus with which we are dealing, I am satisfied that Weber's method as modified by Stanley Griffith gives most reliable indications.

A dose of 0.01 milligram of the bovine tubercle bacillus, injected subcutaneously, causes death from acute and generalized tuberculosis within five weeks, though the same dose of the human tubercle bacillus never produced death within three months, while subcutaneous inoculation of 10 milligrams of the bovine tubercle bacillus into the rabbit causes the death of that animal from acute generalized tuberculosis in from 28 to 101 days. The same dose of the human tubercle bacillus, however, killed only in periods varying from 94 to 725 days. Fiebiger and Jensen appear to be inclined to doubt the value of this test, but the experience of the commissioners on this point is so definite that it would be necessary to bring forward more than negative evidence to overthrow the very positive evidence adduced on this point. I give these tests in full in order that you may have before you the nature of our virulence tests.

Now, may I call to mind the cases examined by our commissioners in which bovine tubercle bacilli were isolated from, and considered to be the cause of, tuberculous lesions in the human subject.

From 28 cases of pulmonary tuberculosis being treated in hospital, sputum was collected, under the most rigid conditions, in order to exclude the possibility of infection from the food. Two of them contained the "bovine tubercle bacillus," which gave the characteristic culture appearances on artificial media, had the dysgonic growth of the bovine type of bacillus, and produced fatal generalized tuberculosis, both in calves and in rabbits. No eugonic human tubercle bacilli could be found in either of these sputa.

As at the Washington Congress on Tuberculosis special attention was directed by the late Prof. Koch to the question of the type of bacilli met with in the sputa of tuberculous patients, a short abstract of these cases, drawn up from the Appendix to the Final Report of the Royal Commission on Tuberculosis, Volume I, pages 149 to 152, may not be out of place:

> From one of these two patients virus H. 27, "R," specimens were collected on four separate occasions at intervals of 76, 117, and 118 days. Cultures were obtained direct from the sputum, on each occasion, but only "bovine" bacilli could be separated. This patient, aet. 21 years, unmarried, was a butcher who had suffered from pneumonia and pleurisy 10 months before admission to hospital on February 3, 1909, and had suffered from cough ever since. When examined, the patient presented signs of consolidation of the upper part of the lower lobe of the left lung. The breath

sounds were weak; there were no crepitations, and no signs of cavitation; the right lung was apparently normal. The temperature varied between 97° F. (36.1° C.) and normal; it had never risen above 99.5° F. (37.5° C.), and this had been reached on one or two occasions only. The sputum was first collected for experiment eight days after the patient was admitted to hospital. Guinea pigs, calves, and rabbits were inoculated both with the original material, and, from time to time, with cultures, and on every occasion the cultures investigated obtained from the sputum of this patient were identical in cultural characters and virulence with the bovine tubercle bacillus, as tested on the first and third occasions on calves and rabbits, and on the second and fourth occasions on rabbits only. This patient went to a sanatorium connected with the hospital in August, 1909, returning home in the following October, where he died on the 22d of December of the same year, six months after the last specimen of sputum had been collected. No clinical evidence was noted of any disease other than pulmonary tuberculosis. There was no hemoptysis at any time. It was not possible, however, to obtain a post-mortem examination.

The second virus, H. 128 "D. D.," giving similar results, was obtained from the sputum of a patient, a man aet. 31 years, unmarried, a bricklayer, who was admitted to hospital on 20th of January, 1909. No family history was taken. The patient had had pneumonia on the left side 11 years, and pleurisy four months before admission. He had had slight hemorrhages, each lasting for a few days, some time before admission, and had suffered from night sweats, but had no cough. On examination signs of infiltration of the whole of the upper lobe of the right lung, with consolidation of the apex, and weak breath sounds with increased vocal resonance over the upper lobe of the left lung were noted. There were no signs of cavities. The temperature showed a slight diurnal variation, but no rise above 99° F. (37.2° C.). The patient's condition improved in hospital, and he gained in weight. Sputum was first collected for experiment on 11th of February, 1909, and again on 9th of June of the same year. The cultures obtained from both of the sputa were identical, both in cultural characters and in virulence for the calf and the rabbit, with the bovine tubercle bacillus. This patient also went to a sanatorium in August, 1909, but returned home early in November without having shown any sign of improvement. At this later date he was suffering from hemoptysis and hematemesis, with acute enteritis. He died on 14th of November, 1909, five months after the last specimen of sputum had been collected. An unsuccessful attempt was made to obtain a post-mortem examination.

What further evidence have we? Of the organs and tissues of 108 cases of tuberculosis examined by the commission, in 2 cases, 1 in which the bronchial glands and the spleen were affected, and in a case in which the bronchial glands, meninges, lung, and mesenteric glands were all affected, both human and bovine bacilli were found. Of 29 cases of primary abdominal tuberculosis, 14 yielded bovine tubercle bacilli only, whilst in 2 cases both types of bacilli were demonstrated and separated. Of the 14 cases containing the bovine bacillus, 10 were children between 1 and 3 years of age, 3 between 4 and 5, and 1, 8 years of age, and of the 14 cases, 6 died from generalized tuberculosis, 2 from tuberculous peritonitis, and 3 from tuberculous meningitis.

In view of the experience of some of our most reliable surgeons, it is interesting to find that of 14 cases in which bone and joints were affected, from which the scrapings of the joint and the discharge from the lumbar, scapular, sacral, and rib abscesses were examined, only one case gave the bovine bacillus, and it was accompanied by the human type of bacillus.

Thus it is seen that of the 108 cases of human tuberculosis investigated, 19 yielded "bovine tubercle bacilli" only, whilst in 5 both types were undoubtedly present.

A careful analysis of the cases in which the bovine tubercle bacillus was found discloses evidence of infection through the alimentary canal; i. e., much of it is cervical gland tuberculosis and primary abdominal tuberculosis. In 38 such cases it is found that 17 are due to the bovine tubercle bacillus alone, but in 2 others both types of organism are present, whilst of the primary abdominal cases alone, of which there are 29, the bovine bacillus is present in 16, and in 14 (nearly 50 per cent) it is the sole infective agent present.

A most interesting group of cases is that included under the term "lupus." In only one of a number of cases of this disease was a bovine bacillus, fully virulent for the rabbit, calf, monkey, and guinea pig, found and isolated. In 6 cases the bacilli separated had the morphological and cultural characteristics of the bovine bacilli, but all of them had a lower virulence for the calf than had the bacilli obtained from bovine sources. In rabbits they produced generalized tuberculosis, which, however, ran a much slower course than that produced by the true bovine bacillus.

One other member of this group grew like the bovine bacillus, but had a low virulence for the calf—not higher than that of the human tubercle bacillus; it was very slightly more virulent for the rabbit, producing fatal tuberculosis when injected intravenously, and when injected subcutaneously produced chronic tuberculosis.

Another bacillus of this group, also growing like the bovine bacillus, but with a slightly pigmented growth on serum, had a virulence for the calf about equal to that of the bacillus of human tuberculosis, whilst for the rabbit its virulence was lower than that of either the bovine or the human tubercle bacillus.

It has been suggested that these bacilli are modified "bovine" tubercle bacilli, the modification resulting from the residence in tissue in which the organisms can not retain their original virulence and other bovine characteristics. Should these be accepted as of "bovine" type it would increase the percentage of bovine infections considerably.

To this interesting group of cases may be added 64 cases of swine tuberculosis and 5 cases of equine tuberculosis. In the localized tuberculosis of the pig the bovine bacillus was the agent at work in

18 cases out of 26, and, in generalized tuberculosis of swine the bovine bacillus alone was found in 32 out of the 33 cases; in the other case, there was a mixed infection by both the avian and the bovine bacillus. In 50 out of the 59 cases, then, the bovine bacillus only was found, and in one there was mixed avian and bovine infection.[1]

All of these 50 bovine cases gave cultures identical in all features with those described above as being characteristic of the bovine tubercle bacillus, and, with one exception, they all had the full bovine virulence.

Tuberculosis of the horse resembles tuberculosis of swine in so far that it is primarily an infection of the glands and organs associated with the alimentary tract. In one of the five cases examined, there were tuberculous lesions in the mesenteric glands and spleen, in one, the mesenteric glands alone were involved, in a third, the spleen was the only organ involved, whilst in the two remaining cases the mesenteric glands, spleen, and lungs were all affected. All the cases, then, were alimentary tract infections.

The bacilli isolated from three of the viruses were similar to the bovine tubercle bacillus in their virulence for rabbits and guinea pigs; two of them, tested on calves and pigs, produced generalized fatal tuberculosis, but the bacilli isolated from the other two of the five viruses closely resembled each other in the following points: The bacilli, although they had the cultural characteristics of the bovine tubercle bacillus, differed from it, in that they did not produce an acute disease in calves when doses of 50 milligrams of culture were given subcutaneously. Less severe disease was produced by them than by the bovine bacillus when injected into rabbits and monkeys; and although they were capable of producing acute disease in pigs and guinea pigs, these animals survived longer after inoculation than did similar animals inoculated with the bovine tubercle bacillus. On the whole, however, the properties of these viruses resembled those of the bovine bacillus more closely than they did those of the human or avian type.

Finally, a culture isolated direct from the mesenteric gland of a cat, grew like the bovine tubercle bacillus, and produced fatal generalized tuberculosis in rabbits.

The cases of lupus and equine tuberculosis are, as has frequently been pointed out, of special interest in so far that, from some of them tubercle bacilli of apparently protean characters, cultural and pathological, have been separated. Stability is characteristic of most of the forms separated from the visceral organs of the human subject on the one hand and of the bovine animal on the other, but certain of the bacilli cultivated from the lupus lesions and from the visceral organs of the horse appear to be in a condition of unstable equilibrium, since such diverse degrees of virulence and morphological features are found in the series; whilst in a few cases actual modifications, even during cultivation in the laboratory, has been suspected, even though actual demonstration can scarcely be said to have been accomplished. The forms found and demonstrated are, however, sufficient to provide intermediatelinks between what, by some, are held to be distinct and separate types. They thus afford evidence, indirect though it be, that there is a possibility of modification, perhaps very slow and gradual and under conditions not yet attainable in experimental work, of the "human" type of tubercle bacilli to the "bovine," or, conversely, from the bovine to the human type. For our special purpose, the answer to the third term of reference to the Royal Commission is the only one that is of importance; in this it is asserted that, although only rarely has a pulmonary lesion in man yielded the bovine bacillus, in nearly one-half of the examined cases of young children dying of primary abdominal tuberculosis, the fatal lesion could be referred to the bovine bacillus alone; and that, of children and adolescents suffering from cervical gland tuberculosis, a large proportion of the cases examined were the result of infection with the bovine tubercle bacillus. Also, that (*a*) a considerable proportion of the tuberculosis affecting children is of bovine origin, more particularly that which affects, primarily, the abdominal organs and the cervical glands; (*b*) both these forms of tuberculosis are often due to ingestion of tuberculous infective material; and (*c*) much of the tuberculosis of childhood must be ascribed to infection with tubercle bacilli of the bovine type transmitted to the child in meals consisting largely of the milk of the cow.

Finally, may I be allowed to conclude as I hoped to be able to conclude in Berlin in July of this year. Dr. Weber, in a recent paper, has provided us with a very judicial and judicious summary of a great part of this complicated subject, and I agree that, if we take as a standard the figures collected by Prof. Kossel and by Dr. Weber, the percentage of tuberculous cases deriving their origin from a bovine source is small though, I hold, by no means unimportant. If the pulmonary cases alone are considered, the case for bovine infection receives from these figures still less support; but when we take the British Royal Commission figures, it comes out that something like 7 per cent of the whole of the cases of tuberculosis examined were the result of bovine infection, and that, of the sputa from a series of cases of pulmonary tuberculosis, 2 out of 27 contained nothing but bovine bacilli. From this it is evident that in London, at any rate, the bovine bacillus has a rôle not so subordinate as would appear from the consideration of figures collected over wider areas (4 or 5 out of about 800); whilst in my opinion—though it is very unsafe to prophesy—it will be found that in Edinburgh the bovine type of bacillus plays a still more important part. On some of the points here raised there may be differences of opinion amongst us, but on one point we are still agreed; that in the light of present knowledge we must wage unceasing warfare on pulmonary tuberculosis and that one of our great aims must be the diminution of what is recognized under the term "massive infection." That being the case, and whatever may be the state of matters elsewhere, our experience in England compels us to the conclusion that one of the carriers of this massive infection is milk from the tuberculous cow, and we realize that amongst the preventive measures to be taken must be the elimination of such source of infection.

I now come to a most interesting method of attacking the problem of determining the relative importance of the bovine bacillus in the production of tuberculosis in the human subject, a method elaborated by Prof. Delépine, of Manchester. Delépine assumes that if reliable statistics can be obtained as to the number of deaths from tuberculous disease resulting from infection by the alimentary canal and of those resulting from infection through the lungs—and thus the relative rate of rise or fall of the death rate from pulmonary and alimentary tuberculosis—it will be possible to form some idea as to the relative importance of infection from human and bovine sources, of course, making due allowance for possible infection from bovine sources through the human lung, and from bovine sources by infection of the upper part of the alimentary respiratory tract with dry tuberculous material carried by the air, or with tuberculous products carried in food. In all this age incidence must, of course, play a most important part for, as Delépine puts it, "if these suppositions are correct, the mortality from tuberculous diseases other than phthisis, in young children, should be greater than the mortality from phthisis, and the reverse should be true when tuberculous food becomes less important, and exposure to many sources of infected dust becomes more frequent.

Obtaining his figures from an analysis of the statistics contained in the supplement to the Sixty-fifth Annual Report of the Registrar General of England and Wales, he finds that, during the years 1891–1900, tuberculosis, other than phthisis, is responsible for a little less than one-third of the total number of deaths attributable to tuberculosis, 30.84 to 69.16 in every 100 deaths from tuberculosis. These he holds, and what has already been stated tends to corroborate this, may be taken as the "proportions due possibly to food infection and those probably due to aerial infection." He finds, further, that the annual mortality from tuberculosis per million persons living at all ages and at eleven groups of ages during the decennium 1891–1900, in England and Wales, was as follows:

	Tuberculosis in all forms.	Phthisis.	Tuberculosis other than phthisis.
All ages	2,010	1,391	619
0 to 5, exclusively	3,930	413	3,517
5 to 10, exclusively	724	206	518
10 to 15, exclusively	669	368	301
15 to 20, exclusively	1,396	1,144	252
20 to 25, exclusively	1,936	1,730	206
25 to 35, exclusively	2,302	2,135	167
35 to 45, exclusively	2,742	2,592	150
45 to 55, exclusively	2,492	2,362	130
55 to 65, exclusively	2,007	1,881	126
65 to 75, exclusively	1,263	1,154	109
75 and upward	512	437	75

Taking the two extremes of life, it is seen that, from 0 to 5 years of age exclusively, the annual mortality from phthisis was 413; from tuberculosis other than phthisis, 3,517; whilst, at the age of 75 and upward, the annual mortality from phthisis was 437, and from tuberculosis other than phthisis, 75. Moreover, the proportion of the mortality from tuberculosis other than phthisis remains fairly high until the age of 15 is reached, and then falls very rapidly, continuing low in all the following age periods. This is brought out more clearly by taking two groups of these cases, one from 0 to 5 years exclusively, in which, for every 100 deaths from phthisis, there are 850 cases of tuberculosis other than phthisis; whilst, in the second group, 35 to 45 years, there are, for every 100 cases of phthisis, fewer than 6 deaths from tuberculosis other than phthisis. Here the contrast is remarkable and highly suggestive. It is obivous that all the infected children becoming tuberculous before the age of 5 years did not die during that period; many of them must linger on for 5 or even 10 years and ultimately succumb to tuberculosis extending, more or less rapidly, from the primary lesion to other organs of the body. My own figures corroborate Delépine's abstract statistics in a very remarkable fashion. Now let us see what use Delépine makes of these statistics. Working in conjunction with Dr. Niven, the medical officer of health for Manchester, he made a thorough examination of the sources of the Manchester milk supply for the presence of tubercle bacilli, and in no town in the Kingdom, and probably in no city in the world, except perhaps Copenhagen, has the milk supply been more thoroughly controlled than in Manchester. Any improvement in the mortality from tuberculosis, as the result of measures taken to control the milk supply, should, therefore, be better seen in Manchester and in Copenhagen than elsewhere.

In the first place, has there been any improvement in the Manchester supply itself? Evidently there has, for the percentage of samples found to contain tubercle bacilli was in the period 1897–1899, 17.2; whilst in 1910 this percentage figure has been reduced to 6 or, taking the six years from 1905–1910, 6.7 per cent. Simultaneously there was, of course, marked improvement in the sanitary conditions of Manchester. As a result of all this there was, naturally, a fall in the mortality from tuberculosis as a whole. Bearing on this improvement, Delépine says "that if the reduction in mortality from tuberculous diseases other than phthisis is proportionately greater than the reduction in the mortality from phthisis and from all causes, it is reasonable to claim that this result is, in all probability, due to improvement in the milk, and the amount of that improvement may be taken as a basis for a low estimate of the share by bovine tuberculosis in the infection of human beings." In order to determine how far such improvement has taken place, he has given us a series of tables showing the mortality ratio of persons at all ages for the years 1906–1910, as compared with 1891 to 1895, and he finds that, had the average rate of mortality maintaining in 1891–1895 remained unaltered, (*a*), the mortality at all ages observed in 1906–1910 from "all causes" would have been 133, instead of 100; from "phthisis," 126, instead of 100; from "other tuberculous diseases," 164, instead of 100. There was thus a fall in the mortality of 33 in the first group, 26 in the second group, and 64 in the third group; (*b*), the mortality of children under 5 years from "all causes" would have been 143 instead of 100, or a fall of 43; the mortality from "phthisis" remained practically unaltered, and the mortality from "tuberculosis other than phthisis" would have been 198, or a fall of 98; whilst (*c*), comparing the mortality of children under 1 year from "all causes" at the later period with that at the earlier period, we should have the figure 126 against 100, or a fall of 26. From "phthisis" there is no change; whilst from "tuberculosis other than phthisis" the figures are 212 against 100, or a fall of 112.

Comparing England and Wales with Manchester in this respect, the differences between the ratios relating to tuberculosis other than phthisis are as follows: All ages, England and Wales, 141; Manchester, 164, or a gain for Manchester of 23; under 5 years, 153 for England and Wales; Manchester, 178, a gain for Manchester of 25; under 1 year, 175 for England and Wales; Manchester, 194, a gain for Manchester of 19. Delépine concludes, from his complete investigation that, taking all this evidence into consideration, "it is possible to say without fear of exaggeration that not less than 25 per cent of the tuberculous children under 5 years of age suffer from infection of bovine origin, and that this estimate is much lower than one based on probabilities would be."

These figures seem to bear out in a very striking fashion the experience of Copenhagen where, under the advice of Prof. Bang, greater precautions, probably, have been taken to eliminate tubercle bacilli from the milk supply than in any other large city on the Continent, or in the United States, with the result that, comparing the curves of tuberculosis mortality in the different countries with that of England and Wales as the longest and, perhaps, the most perfect, it is found that the mortality from tuberculosis in Copenhagen has fallen from a point considerably above that of the English curve for an early period to a point now definitely below that curve, the two lines crossing at a point representing a period after Bang's advice had begun to be followed. This is, of course, in addition to the general precautions against phthisis that have been taken in both countries. It would be extremely interesting to have the tuberculosis figures of Copenhagen, Liverpool, London, Edinburgh, Dublin, and New York, say, analyzed and compared, as in Delépine's scheme, and I have brought the matter forward at this meeting in order to draw attention to the great value of his method in educing statistical data as to the amount of "alimentary" tuberculosis in different areas, and, therefore, with certain corrections, of "bovine" tuberculosis. I have no doubt that corresponding figures from Berlin, Paris, and Lille, say, would also afford very interesting information on these points.

When in Rome, and talking with my esteemed colleague, Prof. Kossel, I suggested that it might be a good plan to form a small international consultative body, the members of which might meet from time to time, keep in more or less close and constant communication and discuss some of the problems by which we are at present confronted. In the first instance we might agree as to the best methods to be adopted in the differentiation of types of bacilli, and the importance of any modifications of recognized methods. For example, how far the slight modification made by Stanley Griffith on Weber's excellent plan of using the rabbit as a differentiating culture ground for the human and bovine types of the tubercle bacillus, is of value; or again, what are the possibilities of overlooking the dysgonic bovine type of tubercle bacillus in broth seeded with material from various tuberculous cases. Many other similar questions suggest themselves, but these will serve as examples of the type of question that might be discussed. Such a consultative body must necessarily be limited in number, and must be more or less private in character. I may say that on mentioning the matter to my colleagues, Drs. Cobbett and Stanley Griffith, they fell in most heartily with the suggestion. Much work might be involved, but would it not be worth our while to undertake it?

Gentlemen, we, in our country, are just entering a new phase of this important question, and we hope, with the benefit of the experience that we have gained, to improve upon and develop methods now in use. It may be that the problems by which we are confronted are not quite the same as are yours, but we recognize that the main features of these problems are identical in the two areas, Great Britain and the Continent of Europe, and the United States of America. A few years hence, when our insurance and sanatorium benefit schemes have been proved, and when statistics have been collected, I hope that we shall be in a position to consider on what further work we can unite in continuance of our campaign against the tubercle bacillus and tuberculosis in all its many and varied forms.

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[1] From the fact that we have the bovine form in local tuberculosis, that we have similar cases in which only the human and avian varieties are present, and that we may have the avian virus mixed with the bovine, it is obviously imperative that all the lesions of swine tuberculosis should be treated as containing virulent tubercle bacilli, as the means of differentiating these forms can never be rendered available for rapid diagnosis, especially in the conditions under which swine must be slaughtered and dressed.

THE RÔLE OF BOVINE TUBERCULOSIS IN THE PRODUCTION OF HUMAN TUBERCULOSIS.

Prof. William H. Park, director, research laboratory, department of health, New York City. Professor of bacteriology, New York University.

The investigations carried on in this laboratory during the past four years had for their object the discovery of the amount of human tuberculosis in New York City due to bovine tubercle bacilli, that is, to infection through milk and its products. When the work was first undertaken, it was not fully decided whether the characteristics which Theobald Smith had pointed out as differentiating the variety found regularly in cattle from that found in most cases in man were stable. We therefore injected numerous cattle with human cultures. We found no appreciable change in the bacilli which had remained in the cattle for months. We also compared carefully the bacilli of bovine type which, on account of the chromicity of the lesions, must have been in the human body for years, with those obtained from acute cases. We found no difference. Similar results have been obtained by other investigators. There is, in fact, no conclusive evidence that anyone has been able to change a culture of either type into the other. It is true that the English commission found that some of the strains of the bovine type of bacilli found in lupus cases which were of less than the usual number in rabbits and calves, recovered greater virulence by passage through animals. The cultural and morphological characteristics, however, remained unaltered. Most of the cases which at one time were considered to indicate the probability of a rapid change in type are now known to be examples of infection with both types at the same time, or of the development in the calf of a latent or later acquired bovine infection. Whatever may be the previous and present relationship of these two closely allied types of bacilli, we now know that they are usually so distinct in their characteristics as to clearly indicate their source.

While investigators are not yet able to agree on the exact relations existing between these two closely allied varieties of tubercle bacilli, they are assured that the differences found between the two types are not only so distinct as to be apparent to the trained observer, but are also so stable that one type does not change to another at all, or, at least, not during the few years in which they remain in a diseased person. We are enabled, therefore, to judge the amount of bovine infection in human tuberculosis by determining the frequency with which bovine bacilli are met with in the different varieties of human tuberculosis. This really indicates the frequency with which infection takes place from milk and butter, for while it is theoretically possible that bovine bacilli, which have passed from a cow to a child, might be later conveyed to another child, yet this, if it ever happens, must be very seldom, for after infancy bovine infection is practically limited to the lymph nodes, and there is little chance for infection to escape from the infected glands to others. The prevalence of bovine bacilli in the general milk supply and, to a less extent, in the butter, gives an ample source for infection. It may be of interest to note that, of over 100 samples of market milk examined four years ago, about 12 per cent showed infection with tubercle bacilli, while a series of tests just completed shows 6 per cent to be infected. Thirty samples of butter taken recently, when tested, failed to produce tuberculosis.

We are, I believe, justified in assuming that when we find in a human being tubercle bacilli growing on egg or serum media, as the bovine bacilli, and having in rabbits the virulence of the bovine bacilli, that these have come from milk or its products.

Some observers have occasionally met with cultures which did not present clear-cut characteristics of either type. We were fortunate, in that we were able to closely identify every one of our cultures as belonging to either the bovine or human types. The details of our work have been published in a joint article by Krumwiede and myself in the Journal of Medical Research.[1] The results can be best shown by grouping the cases in several tables:

Final tabulation of cases examined.

Diagnosis of cases examined.	Adults 16 years and over.		Children 5 to 16 years.		Children under 5 years.		Notes.
	Human.	Bovine.	Human.	Bovine.	Human.	Bovine.	
Pulmonary tuberculosis......	281	......	8	......	7	......	Clinical diagnosis only known and therefore no positive details as to the extent of lesions elsewhere.
Tuberculous adenitis, inguinal and axillary.	1	......	4	......	......	......	(See next.)
Tuberculous adenitis, cervical.	9	......	19	8	6	13	In 2 cases cultures were from axillary nodes but the primary focus was cervical. Another case died shortly afterward with pulmonary tuberculosis.
Abdominal tuberculosis......	1	......	1	1	1	3	Milk supply of 1 child subsequently examined. Tubercle bacilli isolated.
Generalized tuberculosis, alimentary origin.	......	......	......	......	1	2	Only 3 cases given under this heading. Many of the cases in the following subdivisions showed marked intestinal lesions and some possibly were of alimentary origin.
Generalized tuberculosis......	2	......	1	......	18	4	1 bovine case had tuberculous osteomyelitis of the metatarsal bone.
Generalized tuberculosis, including meninges.	1	......	......	......	25	1	
Tubercular meningitis........	1	......	2	......	26	2	No autopsy. Extent of lesions elsewhere unknown.
Tuberculosis of bones and joints.	1	......	10	......	7	......	
Genito-urinary tuberculosis...	6	1	1	......	......	......	The adult bovine case was tuberculosis of kidney. Removal of kidney. Complete recovery.
Tuberculosis of skin..........	1	......	......	......	......	......	
Tuberculous abscess..........	1	......	......	......	......	......	Possibly primary in bone.
Total....................	305	1	46	9	91	25	

Double infection, 1 case. Both types isolated. Generalized tuberculosis including meninges, 13 months. Mesenteric nodes gave human type. Meningeal fluid gave bovine type. Total cases, 478.

We will first consider the findings in the 478 cases together and then study some of the groups separately.

The findings in the 296 cases of pulmonary tuberculosis agree closely with those of other investigators with the exception of the English commission. The latter found two cases of bovine infection which ran a fatal course.

The large amount of bovine infections in tubercular glands of the neck in both younger and older children is very impressive. This form of disease, although rarely fatal, is nevertheless a serious one and, if neglected, is apt to cause impairment of health, and disfigurement.

The percentage of bovine infection in abdominal tuberculosis is still more marked, but because of its comparative rarity is of less importance. The progressive fatal tuberculosis of very young children is seen to be due in nearly 10 per cent of the cases to bovine infection. These fatal cases deserve consideration by themselves:

Total fatal cases in children.

Diagnosis.	Children 5 to 16 years of age.		Children under 5 years.		Notes.
	Human.	Bovine.	Human.	Bovine.	
Pulmonary tuberculosis	....	....	7	....	One case included, probably fatal, data incomplete.
Tuberculous adenitis	1	....	....	....	Other cases recovered as far as is known.
Abdominal tuberculosis	....	....	....	3	Three other cases, one bovine and two human, were operative cases with recovery as far as known.
Generalized tuberculosis	1	....	19	4	Two other bovine cases died directly of exanthemata with complications.
Generalized tuberculosis, including meninges.	....	....	25	2	One case gave both types of bacilli, included under bovine, as this type caused the meningitis.
Tubercular meningitis	2	....	26	2	
Total	4	....	77	11	Or 12½ per cent due to bovine type under 5 years.

Among these fatal cases are two groups which possess great interest. Those from the Babies' Hospital represent the average New York baby and those from the Foundling Hospital the baby fed on cows' milk:

Fatal cases—Babies' Hospital.

Diagnosis.	Children 5 to 16 years.		Children under 5 years.		Notes.
	Human.	Bovine.	Human.	Bovine.	
Pulmonary tuberculosis	....	....	6	....	One case included, probably fatal, data incomplete.
Generalized tuberculosis	1	....	14	2	
Generalized tuberculosis, including meninges.	....	....	21	1	One case gave both types of bacilli, included under bovine, as this type caused the meningitis.
Tubercular meningitis	....	....	18	1	
Total	1	....	59	4	Or 6¼ per cent due to bovine type under 5 years.

The Foundling Hospital receives infants which have been taken sick while cared for by women to whom they have been assigned. These infants are fed on cows' milk. This in many instances is heated before using.

These nine cases are of course a very small number, but the percentage of bovine infection is so high as to be of great interest in suggesting what would happen if all infants were fed on cows' milk from the average farms without previous pasteurization.

Cases—Foundling Hospital.

Diagnosis.	Children under 6 years.		Notes.
	Human.	Bovine	
Abdominal tuberculosis......	....	1	
Generalized tuberculosis......	3	3	Two of the bovine cases died directly of exanthemata; the tuberculosis was not altogether negligible. These two cases not included in the total fatal cases.
Generalized tuberculosis, including the meninges.	1	1	
Total....................	4	5	Total cases, 9.

Age incidence of total fatal cases under 5 years.

Diagnosis.	Between 4 and 5 years.		Between 3 and 4 years.		Between 2 and 3 years.		Between 1 and 2 years.		Under 1 year.	
	Human.	Bovine.	Human.	Bovine.	Human.	Bovine.	Human.	Bovine.	Human.	Bovine.
Pulmonary tuberculosis................	......	......	1	......	......	......	2	......	4	......
Abdominal tuberculosis................	......	......	......	......	......	......	......	[a] 2	......	......
Generalized tuberculosis................	1	......	......	1	3	......	5	2	10	1
Generalized tuberculosis, including meninges..............................	......	......	1	......	2	......	8	[b] 2	14	......
Tubercular meningitis................	......	......	2	......	5	1	10	1	9	......
Total............................	1	......	4	1	10	1	25	7	37	1

[a] One case bovine type, definite age not given, infant. Not included.
[b] Case of double infection included here.

If we further correct the application of the percentages deduced, it is evident from the above table that we should apply them mainly to the first three years of life. The cases examined between 3 and 5 years are few in number. The source of our material did not include many cases about this age and only four cases came to us between 5 and 16 years, not including the pulmonary cases, the outcome of which we could not determine. We are inclined to believe that around the ages of 4 to 5 years the incidence of fatal bovine infection rapidly falls.

We have most carefully gone over the reports of all investigators who have published their results and divided their cases according to the type of bacilli causing infection.

Adding these to our series of 478 cases, gives the following complete tabulation:

Combined tabulation of cases reported and own series of cases.

Diagnosis.	Adults 16 years and over.		Children 5 to 16 years.		Children under 5 years.	
	Human.	Bovine.	Human.	Bovine.	Human.	Bovine.
Pulmonary tuberculosis	778	3	14	....	35	1
Tuberculosis adenitis, axiliary or inguinal	3	....	4	....	2	....
Tuberculosis adenitis, cervical	36	1	36	22	15	24
Abdominal tuberculosis	16	4	8	9	10	14
Generalized tuberculosis, alimentary origin	6	1	3	4	17	15
Generalized tuberculosis	29	....	5	1	74	7
Generalized tuberculosis including meninges, alimentary origin	....	....	1	....	5	10
Generalized tuberculosis including meninges	5	....	10	....	76	1
Tubercular meningitis	1	....	3	....	28	4
Tuberculosis of bones and joints	32	1	41	3	27	....
Genito-urinary tuberculosis	22	1	2	....	....	....
Tuberculosis of skin	10	3	4	6	2	....
Miscellaneous cases:						
Tuberculosis of tonsils	....	....	....	1	....	....
Tuberculosis of mouth and cervical nodes	....	1	....	....	....	....
Tuberculosis sinus or abscess	2	....	....	....	....	....
Sepsis, latent bacilli	....	....	....	....	1	....
Totals	940	15	131	46	292	76

Mixed or double infections, 11 cases; total cases, 1,511.

Our estimate of the amount of bovine infection in man at the present time in New York City is as follows: About 7 per cent of the infants and young children under 5 years of age dying from tuberculosis do so because of infection derived from infected milk or milk products.

Fatal tuberculosis due to bovine bacilli is rare in those over 5 years of age, but, on the other hand, infection of the lymph nodes is frequent; 30 per cent or more of tubercular lymph nodes occurring in children between 5 and 16 are contracted through bovine bacilli.

Judging from the 296 cases examined, pulmonary tuberculosis is practically always due to the human type; that is, contracted from other cases, and not from milk. As the English commission found two adults in London suffering from bovine infection, we must recognize the fact that occasional cases may occur.

The general adoption and enforcement of regulations such as those recently adopted by the New York Department of Health which demand the pasteurization of all milk not obtained from herds of cows free of tuberculosis should almost eliminate bovine infection in man.

The variation in the amount of bovine infection in different communities is probably chiefly due to the difference in the purity of the milk and butter consumed, and to the degree in which infants and young children are fed on unheated cow's milk.

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[1] Vol. XXVII, No. 1, p. 14, and also in Vols. XXIII and XXV.

DISCUSSION.

Dr. M. P. Ravenel, University of Wisconsin, Madison, Wis.: As Dr. Park has said, I think we are now in accord on almost every point concerning this important question. This is true as to the facts. However, on some points we differ concerning the interpretation of the results. There is now world-wide agreement that bovine tubercle bacilli can produce serious and fatal disease in human beings, and that these cases are seen chiefly among children under the age of 16 years, and especially under the age of 5 years.

In regard to what Dr. Weber has said, I would merely point out the fact that while tuberculosis from bovine sources may not he the cause of epidemic disease in human beings, nevertheless each case which originates from this source may act as a focus of infection for a number of other cases. Therefore we must not regard this infection too lightly. We have an analogy in the case of mammalian tubercle bacilli in birds. It is well known that one may inoculate a series of fowls with the mammalian tubercle bacillus, either human or bovine, and that a large number of these birds will escape infection. However, certain ones will succumb to the disease, and from these other fowls can be infected without trouble. I take it that the same thing is true in regard to human infection with the bovine tubercle bacillus.

In regard to what Dr. Park has said, I would insist once more that there is no proof whatever that the tubercle bacillus does not change its type by prolonged residence in a given soil, and I am not willing to accept the statement so positively made that when a germ of the human type is found in pulmonary tuberculosis we can be sure that the case has always originated from a previously existing case of human tuberculosis. If the tubercle bacillus does not change its type according to the soil in which it grows and its surroundings, it is an exception to bacteria in general. As has been pointed out, in consumption of the lungs the tubercle bacillus is living on the dead portion of the lung in direct contact with the outside air—conditions which are favorable to a saprophytic life.

Experimentally, the late Dr. Pearson and myself succeeded in changing one typical human culture into a typical bovine by passage through calves. I acknowledge freely that there may have been some error in this experiment, although every precaution was taken. Eber, of Leipzig, has done similar work and reached similar conclusions. The British Royal Commission has changed the type of several cultures, as is shown in their last report, so that we have some experimental evidence, even if it is not entirely conclusive, of what we would expect theoretically.

Dr. Park has very well expressed the conclusions to be drawn from his series of cases at the Children's Hospital and the Foundling Hospital, but, in my opinion, he has not gone far enough. The first series, we may agree, shows the actual proportion of children in New York City who die from bovine infection. The series of cases at the Foundling Hospital, showing 55 per cent of the deaths due to bovine infection, demonstrates clearly the actual danger which exists to-day from the use of cow's milk. Should children generally in the city of New York and other cities similarly situated be fed on cow's milk to the same extent as the children at the Foundling Hospital are, we would then have the death rate from bovine infection among children at 55 per cent instead of a general average of approximately 12½ per cent. In other words, about 45 per cent of the children are saved through not drinking cow's milk.

Dr. Park's results show very conclusively that upward of 300 children die yearly in the city of New York from bovine infection. I think everyone will agree that, while this may be a small proportion of the total death rate from consumption, it is by no means insignificant and does not entirely justify the classification given by Dr. Weber that bovine tuberculosis is important only to the individual. Further than this, it must be remembered that these figures show only the fatal cases. In addition to the fatal cases, many children are affected with bovine tuberculosis who do not succumb at once. Such infections produce various deformities and injuries. These must be taken into consideration also in estimating the amount of infection of human beings which originates in bovine tuberculosis.

In view of these facts, I would deprecate as strongly as I know how any relaxation in our laws for the safeguarding of our milk supply and in our teaching of the public concerning the danger of cow's milk for children. I lay especial emphasis on this, since, in America, more raw cow's milk is consumed than in any other country in the world. If our teaching concerning this subject or our precautions concerning it were relaxed, we could certainly look for a great increase in the number of deaths among children from tuberculosis of bovine origin.

Dr. E. C. SCHROEDER: There is one danger to which public health may be exposed through the use of raw milk from tuberculous cows to which no reference has been made. It is the influence which the ingestion of such milk, or the ingestion of living tubercle bacilli in any article of food, even when they do not serve as direct etiological factors in the production of tuberculous disease, may have on the development of tuberculous processes which have their origin from other sources of infection. What I mean will be clearer if I make a concise statement concerning an unpublished experiment on this subject, made by my assistant, Dr. W. E. Cotton, and myself, at the experiment station of the Federal Bureau of Animal Industry.

Several groups of guinea pigs were fed on milk. One group received raw infected milk from a cow affected with udder tuberculosis; another group of guinea pigs received milk from the same source, pasteurized at 140° F., maintained for 20 minutes, and another group of guinea pigs received normal, fresh milk from healthy cows. After the feeding had continued for a period of four months, it was stopped. Two months were permitted to elapse, and then, as no guinea pig seemed to have contracted tuberculosis, it was concluded to give each a subcutaneous injection of a minute dose of tuberculous material.

To make sure that the guinea pigs in the one group that had daily, for a period of four months, ingested raw, tuberculous milk were free from tuberculosis, half of the 20 animals in this group were chloroformed and examined post-mortem. As not one of the animals killed showed the remotest lesion of tuberculosis or of any other disease, it was assumed that the animals remaining alive were also free from tuberculosis. The general condition of the guinea pigs, the time that had elapsed since their exposure to infection through the ingestion of milk infected with tubercle bacilli had been stopped, and our knowledge that it is almost impossible to infect guinea pigs with tuberculosis through any form of exposure that does not insure the introduction of tubercle bacilli actually into their bodies through some injury (a puncture or a scratch of the skin or mucous membranes), give the foregoing assumption almost the weight of a conclusively demonstrated fact.

The infected milk used for the guinea pigs was proved to be infectious on 65 days by injecting it into the abdominal cavities of guinea pigs, and the pasteurized milk of the same kind was proved by guinea-pig injections on these days to be free from tubercle bacilli that could cause tuberculosis in guinea pigs. All the guinea pigs injected on the 65 days with the milk in a raw state contracted tuberculosis, and the guinea pigs injected on the 65 days with this infectious milk after it had been exposed to 140° F., for 20 minutes, all remained well.

The normal milk was obtained from a small herd of cattle at the experiment station, in which no case of tuberculosis had occurred during 10 years, and which is semiannually tested with tuberculin.

The tuberculous material injected into the guinea pigs two months after the milk feeding was stopped was one one-millionth cubic centimeter of an emulsion of a tuberculous gland of a guinea pig affected with bovine tuberculosis. This emulsion was made by grinding 200 milligrams of the tuberculous gland in a mortar with 2 cubic centimeters of normal salt solution. The larger particles of the emulsion were permitted to settle, and only the slightly clouded, supernatant fluid drawn off and used. To obtain the very minute dose of tuberculous material, a sufficient quantity of normal salt solution was added, so that one-half cubic centimeter would be the equivalent of one one-millionth of the original emulsion. As the original emulsion already represented a dilution of something less than 1 part of gland in 10 parts of normal salt solution, the dose of tuberculous material injected under the skin of each guinea pig was in reality only one ten-millionth of a gram of tuberculous tissue.

As the ingestion of raw tuberculous milk for a long period of time in no case caused tuberculosis, and as the injection of the minute dose of tuberculous material in every case caused tuberculosis, we have here, on the one hand, an excellent illustration of the resistance shown by guinea pigs when they are exposed with uninjured bodies to tubercle bacilli, and, on the other hand, an equally good illustration of the extreme susceptibility of guinea pigs to tuberculosis when they are exposed to tubercle bacilli that enter their bodies through a puncture or other injury.

The resistance of guinea pigs to infection with ingested tubercle bacilli must not be taken as evidence that it is safe to ingest tubercle bacilli, because experiments made by Dr. Cotton and myself show that hogs, for example, are easily infected with tuberculosis through the ingestion of tubercle bacilli, and that an actually smaller amount of tuberculous material than a guinea pig can ingest with impunity may, and frequently does, cause tuberculosis when ingested by hogs weighing 75 pounds or more.

But to return to the several groups of guinea pigs. Those that were fed raw, infected milk, and were subsequently injected with tuberculous material, all eventually died of tuberculosis, and lived 18 per cent less time than those that were fed pasteurized tuberculous milk and normal raw milk, all of which also eventually died of tuberculosis as the result of the injection of tuberculous material.

While it is not fair to draw final conclusions from a single experiment, the work done seems to indicate that the ingestion of food, either dairy products or other food, that contains living tubercle bacilli, may so influence the body of an animal that an existing tuberculosis is stimulated to greater activity, or a subsequent tuberculosis is enabled to progress with undue rapidity.

More work on this subject has been planned.

Relative to the transformability of tubercle bacilli from one type to another, I believe the last word has not been said. We know very well that the tubercle bacillus is a mutating organism, which can be changed through the selective influence of environment, so as to become either more or less virulent or more or less vigorous in its growth on artificial culture media. The relative great frequency of bovine types of tubercle bacilli in the lesions of children; the data we have for assuming that infection with tubercle bacilli, when considered apart from the development of tuberculosis as a clinical disease, is commonly an event that occurs during childhood; the evidence we have that tubercle bacilli may remain nearly, if not entirely, dormant in animal tissues without losing their virulence for long periods of time; the gradually diminishing frequency of bovine tubercle bacilli in human tuberculosis with the increase of age, and their almost total disappearance after the age of adolescence, and a number of other allied factors, give us food for serious thought, and certainly caution us not to conclude too hastily, on the basis of experiments that have not been carried on for a sufficient length of time or under really satisfactory conditions, that the transformation of tubercle bacilli from one type to another does not occur.

But this question of the possible transformation of types need have no influence on the practical measures we must recommend for the protection of public health against infection with tuberculosis from bovine or other animal sources. We are all agreed to-day that tuberculosis among animals is a sufficiently serious source of tuberculosis among human beings to require that no animal food shall be eaten unless it is either obtained from animals certainly free from tuberculosis or has first been exposed to some process, like heating, to make the tubercle bacilli it may contain innocuous.

Dr. Unterberger: In den Discussionen wurde nur von auslosenden Momenten bei der Entstehung der Tuberkulose gesprochen und nichts gesagt von auszulosenden Momenten. Wie zu einem Brande ein Funken und ein Geböude nothig sind, so auch zur Entstehung einer Krankheit, so auch der Tuberkulose, ein Infektionsträger und ein spec. schwacher Organismus. Nicht jeder Funke erzeugt Brand, nicht jeder Bacillus eine Tuberkulose. Gegen Brandschaden kämpfen wir durch Bauten von feuerfesten Gebäude, gegen Tuberkulose kämpfen wir mit Erfolg in erster Linie mit einem erkannten Organismus. Daher ist unsere Hauptaufgabe beim Kampfe mit der Tuberkulose unseren Körper zu stärken, damit die Osmose in allen Organen geregelt wird, dann hat der Bazillus wenig zu sagen.

Wir müssen bei einer erfolgreichen Bekämpfung mit der Tuberculose nicht ausschliesslich bacteriologisch denken sondern auch biologisch.

Dr. Park. In answer to Dr. Ravenel's statement that he sees no reason to believe the tubercle bacilli do not change their characteristics like other bacilli, I wish to state that all that I intended to assert was that the changes which took place did not prevent the identification of the type. So far as the bacilli obtained from the tissues of children were concerned it was remarkable how little the bacilli of the bovine type which had been in the body for years differed from those obtained from cattle or from children in which the infection could have lasted only a few months. Dr. Ravenel surely knows that in nearly all the experiments in which human

bacilli were inoculated in cattle they retained their human type characteristics as long as they remained alive in the bodies of cattle.

Dr. Weber has already pointed out that the British commission has changed its opinion and now considers that the apparent change in type of bacilli in certain calves was due to the well-demonstrated fact that a small percentage of human cases contains both types of tubercle bacilli and that the apparent transformation was simply the greater development of the more virulent bovine type in the calves.

Dr. Weber: Herr Ravenel hat ausgeführt, jedes mit bovinen Bazillen infizierte Kind könne eine Infektionsquelle für seine Umgebung abgeben. Dem gegenüber möchte ich darauf hinweisen, dass es sich bei den bovinen Infektionen in den meisten Fällen um geschlossene, nicht um offene Tuberkulosen handelt. Seit von der englischen Kommission 2 Fälle von Phthise, beruhend auf bovinen Bazillen gefunden worden sind, muss man allerdings an die Möglichkeit der Uebertragung boviner Bazillen von Mensch zu Mensch denken. Bisher ist aber noch kein derartiger Fall beobachtet worden. Ich habe mir vorgenommen nach solchen Fällen zu suchen.

Auch die Möglichkeit der Umwandlung der bovinen in die humanen Bazillen will ich nicht ohne weiteres ganz und gar abweisen, aber ich muss wieder betonen, dass eine solche Umwandlung bisher nicht beobachtet ist. Die Frage ist aber jedenfalls sehr wichtig und sowie ich wieder nach Deutschland zurückgekehrt sein werde, werden wir gemeinsam mit Herrn Prof. Eber neue Versuche anstellen. Wenn ich Herrn Ravenel richtig verstanden habe, hat er die englische Tuberkulosekommission als Zeuge für die Umwandlungsanschauung angeführt; dazu möchte ich bemerken, dass die englische Kommission im Second Interim Report der Umwandlungstheorie zuneigte, im Final Report nimmt sie jedoch einen anderen Standpunkt ein, da sich inzwischen gezeigt hatte, dass es sich bei den ursprünglich als Ueberganskulturen angesehenen Kulturstämme um Mischkulturen beider Typen handelte. Ich habe ausdrücklich betont, wir wollen alle Hypothesen und unbewiesenen Theorien bei Seite lassen und uns nur an das Tatsächliche halten.

Geschieht dies, so kann man zu keinen andern Schlussätzen kommen als zu den von mir aufgestellten.

TWELVE YEARS' EXPERIENCE OF COMPULSORY NOTIFICATION OF PULMONARY TUBERCULOSIS IN SOUTH AUSTRALIA.

W. Ramsay Smith, D. Sc., M. B., C. M., F. R. S. (Edinburgh).

On the 1st of January, 1899, the health act of 1898, a consolidating measure, became law in South Australia. Some of its provisions were ahead of the times. Like all such provisions, these demanded delicate handling.

Under the act, "Every medical practitioner attending on or consulted by any person suffering from pulmonary tuberculosis shall, as soon as the fact becomes known to him, report the same to the local board of the district in which the person resides, provided such notification shall not be necessary if the case has been previously reported to the same local board." The local board sends a copy of the report to the central board of health.

The act was defective in two respects. It did not provide for payment for notification of tuberculosis, as it did in the case of other notifiable diseases; and it made no provision for supervising, controlling, segregating, or otherwise dealing with consumptives, although it gave certain powers to deal with infected houses and materials.

At the time when I was appointed permanent head of the department of public health and chairman of the central board of health, the act had been in force for about nine months. The provisions dealing with tuberculosis had received but little attention. The number of cases reported at the end of the first 12 months amounted to less than 70 per cent of the deaths registered. Obviously there was leakage in notification. It was recognized that the law must be enforced, or else that the notification provisions must be repealed.

A few warnings to medical practitioners, with a judicious prosecution or two as a collateral, increased the number of notifications. Local boards of health paid for the greater number of notifications, a course which removed any objection or excuse that practitioners might have for remissness in doing their legal duties; and some local boards began to exercise some supervision over their consumptives. A good deal of interest was evinced by the laity in the general subject of consumption; an interest encouraged, as is not unusual, by professional men who had something to gain in the matter, either present or prospective.

It was by no means easy to hold the balance true between public interests and individual rights. Two things proved important at this time. Firstly, anxiety regarding the effect of notification in certain classes of cases was much allayed by the central board intimating to local boards that, if a medical practitioner in reporting a case said that visitation by the officers of the local board was not necessary, the local board might assume that all necessary instructions had been given and all necessary precautions had been taken. Secondly, with the view of making a workable estimate of the number of consumptives alive at any given time, in case it was proposed to make provision for control, I supplied the most accurate data I could obtain, the figures of Bayle and Louis, on the duration of consumption, through Prof. Bragg to Prof. J. R. Wilton, then a student at the Adelaide University, in order to find if it were possible to obtain a coefficient of the death rate that would give the number alive. Mr. Wilton supplied what I have elsewhere called "Wilton's Mortality Curve for Phthisis." Probably it is really a morbidity curve. It shows that at any time the number of those who will die in the next month is one-twelfth of the original hundred who are yet alive. This means that, in a community where consumption is neither increasing nor diminishing, twelve times the monthly death rate will equal the number of consumptives alive at any given time; in other words, and speaking roughly, that the annual total of deaths is the same as the total number alive. This result occasioned some criticism from people who had no mathematical knowledge but who believed that their own estimates, founded on personal guesses or impressions, were much more worthy of public credence than the mathematical interpretation of accurate medical data.

In order to apply to this subject the most searching practical test available, I requested all local boards, in 1906, to supply nominal rolls of all consumptives reported to them at any time since the 1st of January, 1899, and known to be alive on the 31st of December, 1906. Similar rolls have been supplied at the end of every year. By checking these rolls with each other, with the central register of consumptives, with the death certificates supplied by the registrar of deaths, with special returns made by consumptive homes and hospitals, and by particular inquiries made through the police department, we have been able to find out and to "keep the run" of the vast majority of consumptives in the State. Our experience is that Wilton's curve gives a good estimate for practical purposes of the number alive, so far as our State is concerned.

Three years ago the central board had occasion to take an immediate interest and an active part in the sanitary administration of one of the cities, and I asked the nurse inspectors, in the course of their visits to premises where there were cases of infectious disease and consumption, to take notes of the conditions existing. Later on, other districts were visited by the inspectors. The notes taken afford information on many subjects that are of prime importance in connection with any scheme of control, whether voluntary or compulsory, as regards the people, or whether local or central, as regards administration. I shall now refer to some of these, and to the manner in which our experience was gained.

I. THE ATTITUDE OF THE MEDICAL PROFESSION.

Where notifiable communicable disease is concerned, it appears characteristic of the profession everywhere to pay more attention to the medical welfare of the patient than to the legal rights of individuals and the principles of public health administration. Even when they do appreciate the general principles, they are prone to think that the individual patient under their care should be treated in practice as an exception. I think the medical practitioners in this State do not differ greatly in these respects from practitioners elsewhere; probably they are now paying more attention to the public aspect of communicable diseases. Notification, on the whole, is more complete and prompt than formerly, and omissions to report are usually, if not altogether, due to oversight or to the belief that the case has already been notified.

II. THE SOCIAL POSITION OF THE SUFFERERS.

In this State, social position, as such, seems to have little to do with the incidence of the disease. Few, if any, occupations here in themselves specially predispose to consumption. The conditions that favor the origin and the spread of the disease may be found as incidentals in the case of almost any indoor occupation. The disease seems to be "accidental" to the person and to the employment. Speaking generaly, although we have a great variety of occupations in this State, the general conditions under which they are carried on, and the amount of supervision exercised by the State, preclude the occurrence of much "disease of occupation."

III. CONDITIONS OF HOUSING.

In Australia we still have something to learn in the art of adapting our mode of living to our climatic conditions. In a country where we might live almost constantly out of doors in great comfort, and with every advantage that accrues from the natural life, we follow too much the traditions of the "home country" in our style of architecture, in our solid furniture, in our heavy carpets, curtains and hangings, in our times and methods of cleaning rooms, in excluding light because it is trying to the eyes and the complexion and the colors of the carpets and curtains. Ventilation, in summer, usually means "shutting out the heat." In South Australia there has recently been a great change in respect to many of these conditions. House verandas, in which people can live practically out of doors, are common. "Camping out" is a favorite form of holiday making. "Sleeping out" at home in the free fresh air and alone is becoming fashionable among all classes. The effect of these customs is seen in everyday life. For once that you will see a young woman shut the windows in a railway carriage or a tramcar, summer or winter, you will fifty times see her making sure that they are open—and it is to the women, the young women, that we look for the carrying out of measures of healthy living.

Our experience is that consumption is essentially a house disease, due to and encouraged by structural defects, by the want of ventilation, by the shutting out of the sunlight, by dampness in and around the house, and by overcrowding in rooms, especially bedrooms. In offices, both public and private, in factories, in workshops, in schools, wherever there is less fresh air admitted than the workers require, we find we are dealing with the breeding places of consumption. Especially is this so after epidemics of measles and whooping cough.

IV. CONTROL BY LOCAL BOARDS OF HEALTH.

Many of the local boards are apathetic, and not a few are administratively impotent. For some years, however, several of them have made strong endeavors to control tuberculosis and have accomplished a great deal. But they labor under serious disadvantages, such as the lack of information regarding the presence of consumptives who come and live in the district without medical attendance; the want of information regarding the movements of consumptives within the district, and the nonnotification of, and consequent lack of information regarding, deaths (now obviated by notification from the central board on receipt of the Registrar General's certificate); the wandering proclivities of patients who are here in the morning and elsewhere at night; the fact that many consumptives live in one district and work in another; the want of uniformity in the measures and extent of control, of which a consumptive is not slow to take advantage, and, in general, the impossibility of any control that will be complete and uniform, hygienically effective and financially economical.

Certain State conditions affecting administration are peculiar. In Australia, more than in any country in the world, is the population massed round the metropolitan cities. In South Australia, more than in any other State in the Commonwealth, is this the case. About 45 per cent of the whole population, embracing over 80 per cent of the total number of consumptives, live within 10 miles of the capital, under the jurisdiction of about a score of local boards whose boundaries are imaginary lines and not geographical barriers to locomotion, whose populations differ greatly as to numbers, whose rateable values and incomes differ enormously, whose officers show all gradations in number, training and efficiency, and where the proportion of consumptives varies enormously, and bears no relation to any of the factors mentioned.

V. WANDERING PROCLIVITIES OF CONSUMPTIVES.

Apart from, or in addition to, the tendency of the general population in this State to move from place to place, as occupation demands, or for the purpose of visiting friends, or merely for change, the consumptive usually shows an inclination to try places that have been recommended to him as having done good to someone else, whether the other suffered from consumption or from any disease at all. Thus it happens that certain country hotels or boarding houses receive among their visitors more than a due proportion of consumptives. Sometimes the invalids are careless or ignorant of the details of routine precautions; and the landlords and local boards (there are about 150 country local boards) have not the knowledge or means necessary for control.

VI. THE ATTITUDE OF CONSUMPTIVES AND THEIR FRIENDS WHEN THEY KNOW OF THE EXISTENCE OF THE DISEASE.

Without discussing the general question of whether a patient has a right to be told what the physician knows or thinks of the exact nature of any disease from which he may be suffering, we may allow that in the case of a consumptive so much for cure and control depends on the intelligent cooperation of the patient and his friends with the doctor that everyone concerned should know the nature of the disease, provided no harm is done to the patient by the knowledge, or by the method of imparting it. In no case can I find that any harm has been done by telling the friends or the patient the general nature, if not the particulars, of the disease. I would now go so far as to say that we owe consumptives this much as recompense for what we ask from them in the way of precautions.

Patients and their friends have proved ready to take the few simple precautions that we deem necessary for control, and they also show a wonderful readiness (I have met with only one exception) to make every sacrifice in order to become well, or as well as possible.

VII. PRECAUTIONS.

For several years the central board had no means of dealing with consumptives, but recently the services of the trained nurse inspectors, who were appointed for certain purposes of the act, have been utilized either incidentally or specially for visiting, advising, inspecting houses, dealing with insanitary conditions, collecting information, disinfecting premises and articles, and finding how much supervision is being exercised by local boards. These inspectors, besides having been fully trained for three years as nurses in a general hospital and in district work, have all the training, qualifications, and experience in general sanitary work required of the male inspectors of the board, and they are also specially trained in disinfecting and quarantine work.

In connection with disinfection there was at first some concern on the part of the people as to the house furnishings; but now it is usual for the people to apply to have other rooms done as a precaution, once they have seen the method and results of employing the formalin spray. The advice given, the precautions deemed necessary, and the attitude of the central authorities toward the subject of consumption, are set forth in (1) a pamphlet on "The control of communicable diseases in South Australia"; (2) a leaflet giving detailed directions where a case of consumption exists, and (3) a leaflet giving general advice how to live so as to avoid the disease. The schedule of information for the use of the nurse inspectors is what was agreed on at the Conference of Principal Medical Officers of States in 1911, as revised by the Commonwealth statistician.

It is illegal to relet any part of a house that has harbored a consumptive until it has been disinfected to the satisfaction of an inspector of the board of health. This disinfection is usually done free of cost by the authorities. It is not uncommon for prospective tenants now to apply to have rooms or even a whole house disinfected as a special precaution before entry. This also is done free of charge, except perhaps for the cost of the materials used. In this work of disinfecting we find great readiness on the part of the railways, the education and other government departments to cooperate, as also on the part of owners of workshops, factories, and such like places. The aim is a maximum of efficiency at a minimum of money, time, and energy, and I believe we attain it.

VIII. EFFECT OF THE SCHEME OF INVALID PENSIONS.

A year or two ago the Commonwealth government introduced a scheme of invalid pensions (in addition to the old-age pensions), under which any person, unable to work on account of accident or disease would receive 10 shillings a week, if there were no other source of income. This has worked for great good in ways that were not foreseen, particularly in contributing so much to the support of a consumptive that the other members of the family are free to earn their living in a way that was not possible while the invalid was a tax on them for maintenance and attention.

IX. GENERAL POSITION AT PRESENT.

All the work, such as it is, and it is a great deal in practice and in value, of supervising, instructing, disinfecting, and collecting information has been initiated and accomplished by degrees as occasion gave

opportunity, sometimes one authority leading the way, sometimes another; and at the present time we know what staff, what appliances, and what money are necessary for complete and effective control throughout the State. A parliamentary bill has been drafted which, if passed, will provide for such control on the lines agreed to by the Conference of Principal Medical Officers on Uniform Measures for the Control of Consumption in the States of Australia, which met at Melbourne last year.

CONTRÔLE ADMINISTRATIF DE LA TUBERCULOSE PULMONAIRE.

Par le Dr. GUERBET, professeur à l'Ecole de Médecine de Rouen.

Le contrôle administratif de la tuberculose comprend:

1°. La connaissance des cas de tuberculose pulmonaire, c'est-à-dire, la déclaration obligatoire de cette maladie.

2°. L'établissement de fiches par noms et par immeubles des cas de tuberculose déclarés.

3°. Les enquêtes faites au domicile des malades et dans les ateliers et magasins où ils travaillent.

Le contrôle administratif de la tuberculose ne doit pas être considéré comme un but, mais comme un moyen d'action dans la lutte antituberculeuse.

Les anglais ont ainsi envisagé la question et l'assurance obligatoire contre la maladie, qui est entrée en action dans le Royaume-Uni, n'est que le corollaire du contrôle administratif de la tuberculose. La législation anglaise a prévu un capital de 37,500,000 francs qui, prélevé sur les produits de l'assurance obligatoire, sera utilisé à l'établissement de dispensaires et à l'entretien d'institutions ayant pour but les soins et les secours à donner aux tuberculeux.

Il semblera peut-être, que cette question de l'assurance obligatoire contre la maladie est en dehors de notre sujet; mais il nous paraît impossible de songer à établir un contrôle administratif effectif de la tuberculose, sans être certain, par avance, que les soins et les secours matériels nécessaires pourront être donnés aux tuberculeux déclarés; or, seule l'assurance obligatoire contre la maladie permettra, à notre avis, de réunir les sommes énormes nécessaires à cette action.

Ce qu'il faut avant tout éviter, c'est que ce contrôle ne soit qu, "administratif," qu'il ne donne lieu simplement qu'à la création d'un système de fiches et de statistiques. Si, faute d'argent, il se résume en cela, le contrôle sera stérile.

Il ne faut pas se dissimuler que la déclaration de la tuberculose, qui est la base du contrôle, n'est pas populaire. Les médecins, les malades ne l'accepteront qu'à contre cœur, s'ils ne voient dans les enquêtes des bureaux d'hygiène que de vaines formules administratives.

Pour qu'un tel contrôle soit accepté par le public, en France surtout où toute nouvelle loi est l'objet de critiques systématiques, il faut que les malades y voient leur intérêt; il faut que la déclaration de leur cas soit suivie d'un mieux être dans leur situation physique et matérielle. Si le malade est chef de famille, il ne faut pas qu'on se contente de l'hospitaliser tout en laissant les siens dans le dénûment; s'il s'agit d'une mère ayant des enfants en bas âge, il faut que, durant son séjour dans un sanatorium, elle sache que ses enfants sont soignés dans de bonnes conditions.

Si, dès le début de l'établissement du contrôle, l'Etat qui le prescrit n'a pas les moyens financiers suffisants pour assister les tuberculeux, il est préférable qu'il s'abstienne.

Nous supposons donc que le côté financier de la question est résolu.

On aura au préalable constitué un système antituberculeux comme il en existe, par exemple, à Manchester et à Edimbourg; ce système comprendra en substance:

1°. Des institutions de secours matériels aux tuberculeux et à leurs familles.

2°. Des hôpitaux d'isolement pour les cas avancés.

3°. Des sanatoriums.

4°. Des colonies de travail horticoles et agricoles.

5°. Des écoles en plein air.

6°. Des cités jardins aux environs des grandes villes manufacturières.

Tout étant prêt pour une lutte antituberculeuse efficace, on pourra songer, mais seulement à ce moment, à contrôler la morbidité tuberculeuse.

DÉCLARATION DE LA TUBERCULOSE PULMONAIRE.

Comme l'a bien compris la législation anglaise, dans le Public Health Tuberculosis Regulation 1911, la déclaration de la tuberculose pulmonaire est la base de tout contrôle administratif de cette maladie.

"Tout cas de tuberculose pulmonaire, constaté par un médecin traitant, doit donner lieu à une déclaration au bureau d'hygiène."

Là est le principe; l'application en est délicate.

La tuberculose pulmonaire n'est, la plupart du temps, point une affection aigüe qui, comme les maladies épidémiques, se diagnostique d'une façon certaine en l'espace de quelques jours. Le praticien au début de l'affection la soupçonne plutôt qu'il ne l'affirme.

Devra-t-on demander au médecin traitant de déclarer les cas précoces diagnostiqués par les plus légers signes d'auscultation?

Devra-t-on lui demander de faire la déclaration seulement quand il s'agit de tuberculose ouverte?

Si, dans le principe de la déclaration, on n'envisage que la lutte contre un foyer d'infection, comme c'est le cas pour les maladies épidémiques ordinaires, les seuls malades expectorant des crachats bacillifères devront être déclarés.

Mais ce n'est pas seulement pour lutter contre un danger de contagion immédiat qu'on devra faire la déclaration, c'est surtout pour venir au secours d'un malade pauvre qui, soigné à temps, aura des chances de se rétablir; qui, au contraire, abandonné à lui-même, aboutira à la phtisie.

La déclaration de la tuberculose ne doit avoir rien de commun avec celle des maladies aigües, comme la variole ou la scarlatine. Les maladies épidémiques obligatoirement déclarables n'ont qu'une durée éphémère et le temps pendant lequel le malade constitue un foyer d'infection est toujours limité. Il en va bien autrement avec cette maladie à allure chronique qu'est la tuberculose pulmonaire.

Si l'on déclare un tuberculeux dans le seul but de protèger la société contre un danger d'infection, obtiendra-t-on un résultat réel? Evidemment non. On ne peut isoler pendant des années un malheureux phtisique. Alors quel but poursuit-on en dehors de toute idée de statistique? L'amélioration de l'état de santé du malade pauvre? Il aurait mieux valu déclarer son cas alors qu'il était moins avancé; on aurait eu plus de chances d'éviter la création d'un foyer morbide et le malade aurait eu l'espoir d'une guérison.

Critiques dont la déclaration est l'objet:

(A) *De la part des médecins.*—L'objection principale qui nous a été faite en Angleterre par les médecins hostiles à la déclaration obligatoire est celle-ci: La déclaration est une source d'ennui pour les malades, non compensée par les services que peuvent leur rendre les autorités sanitaires.

Mais, si le praticien est persuadé que l'intérêt de son client est en jeu, et nous avons posé en principe que le but de la déclaration était de venir en aide au malade, l'objection tombe d'elle-même.

Il est une autre critique: La déclaration sera inopérante dans la classe aisée. Que nous importe! seules les statistiques en pourront être faussées; cela n'a qu'une importance relative. Dans la classe aisée en général, les foyers de contagion sont peu à craindre; la contagion de la tuberculose n'a rien de commun avec celle des maladies épidémiques ordinaires, qui donnent lieu à de sévères contrôles: La propreté, l'aération des appartements, la diminution de l'encombrement, des mesures d'hygiène générale suffisent, en somme, pour créer une prophylaxie antituberculeuse efficace.

Or, ces mesures d'hygiène sont appliquées en général chez les gens aisés; le médecin habituel pourra, dans tous les cas, les instituer; d'autre part, l'isolement du malade, dangereux pour l'entourage, pourra toujours être discrètement fait. Enfin, la clientèle aisée, par définition, n'a pas besoin des secours du bureau d'hygiène, ni surtout des institutions antituberculeuses gratuites.

D'ailleurs, tout en décrètant la déclaration de la tuberculose obligatoire pour tous, il est bien entendu que, quoiqu'on fasse, le médecin déclarera quand il le voudra bien; rien ne saurait l'y forcer. Il pourra toujours répondre à une observation officielle, que son diagnostic n'est pas définitif, qu'il croit devoir s'abstenir.

Le législateur, tout en rémunérant le médecin qui fera une déclaration, devra la lui demander plutôt comme un service que comme un devoir; d'ailleurs, il est bien évident que, si le médecin est persuadé que la déclaration peut être utile à son client, il le fera de bonne grâce.

(B) *De la part du public.*—Nous noterons une seule objection importante: le malade craint la publicité de sa maladie.

S'il peut être indifférent à un individu que son cas de scarlatine, de variole, de typhoïde soit déclaré, il n'en est plus de même quand il s'agit de la tuberculose pulmonaire. Cette maladie tare l'individu aux yeux de la société; sa durée, sa gravité habituelle, le danger de contagion qu'elle implique, sont des raisons suffisantes pour empêcher, par exemple, le tuberculeux de gagner sa vie, si quelque indiscrétion est commise au sujet de la déclaration de son cas. C'est là une objection de grande valeur.

La déclaration sera faite exclusivement à un médecin du bureau d'hygiène, comme cela est prescrit dans la loi anglaise: Le médecin sera responsable de toute indiscrétion commise dans son bureau. Mais cette déclaration donnera lieu à une enquête au domicile du malade, souvent même dans le milieu où il travaille; ces enquêtes seront facilement l'objet d'indiscrétions graves; elles ne devront être faites que par des médecins, car elles demanderont du tact, une certaine connaissance psychologique de l'individu. Elles ne devront jamais être abandonnées à des employés quelconques, à des bureaucrates n'ayant pour habitude que de remplir sans discernement les fiches blanches qui leur sont confiées.

D'ailleurs, ces enquêtes, pour être fructueuses, exigeront des connaissances médicales de la part de l'enquêteur. Il sera nécessaire de s'informer des habitudes de malade, de l'état de santé de ses parents, de sa femme, de ses enfants; il conviendra souvent au cours de cette enquête, d'examiner rapidement l'entourage du malade, de façon à dépister une tuberculose latente, un prédisposé. S'il s'agit d'un jeune homme dont l'apprentissage n'est pas terminé, dont la profession est incertaine, le médecin pourra utilement l'aiguiller vers une profession plus adéquate à son état de santé, le mettre même en rapport avec les institutions appartenant au système antituberculeux, les colonies agricoles, par exemple.

Si une enquête semble nécessaire dans l'atelier ou le magasin où travaille le malade, il faudra que ce dernier en ait donné l'autorisation; et là encore il sera facile, avec du tact, d'amener le malade à autoriser cette enquête, alors qu'il la refusera net s'il croit n'avoir à satisfaire qu'à un simple caprice administratif.

Cette dernière enquête sera, elle aussi, souvent très utile; elle permettra, quelquefois, de connaître une des raisons pour lesquelles l'ouvrier est devenu tuberculeux: Atelier mal aéré, trop peuplé, et donnera lieu à un rapport aux autorités compétentes, qui pourront faire modifier cet état de choses.

Par le patron qui emploie l'ouvrier, le médecin inspecteur apprendra beaucoup de détails concernant le malade; ses besoins, ses habitudes, son état de fortune.

Cette besogne devra donc être confiée à un ou des médecins spécialement désignés à cet effet par les bureaux d'hygiène; si elle est conduite avec conscience, elle donnera les résultats les meilleurs; si elle est faite avec le sans gêne et l'indifférence habituels aux administrations, elle irritera le malade et son entourage, et ne servira qu'à rendre impopulaire et inefficace l'institution du contrôle de la tuberculose.

Le contrôle sera fait dans les écoles, par le médecin inspecteur habituel; c'est peut-être là où son utilité sera la plus évidente. Ce contrôle permettra de dépister les enfants prédisposés à la tuberculose et de les diriger sur les écoles de plein air. Avant leur départ définitif de l'école, les enfants seront examinés spécialement au point de vue pulmonaire; ceux qui seront tarés, donneront lieu à une fiche de déclaration au bureau d'hygiène; le médecin enquêteur ira trouver les parents, les informera de l'état de santé précaire de leur enfant et les incitera à choisir pour lui une profession favorable à sa santé.

Pour nous rendre compte des résultats que pourra donner la déclaration, nous prendrons comme exemple l'Angleterre:

Dès 1902 des essais ont été tentés à Londres, en particulier, où la mortalité par tuberculose pulmonaire est de 6,000 environ pour 4,800,000 habitants (soit 1.25 pour cent): le nombre de cas déclarés est passé de 1,300 en 1902 à 9,000 en 1912.

La loi sur la déclaration obligatoire de la tuberculose est entrée en vigueur le 1er janvier de cette année; depuis le 1er janvier jusqu'au 1er juillet 17,888 cas ont été déclarés. On est donc en droit d'espérer que l'année 1912 apportera la déclaration de 35,000 cas environ. C'est un véritable succès.

Dans ses détails, le contrôle administratif de la tuberculose pourra être institué ainsi qu'il suit; nous nous sommes inspiré des articles de la loi anglaise et surtout de l'admirable contrôle créé, il y a déjà plusieurs années, par le Dr. Niven de Manchester et qui donne les résultats les plus remarquables.[1]

Le bureau d'hygiène devra avoir un service spécial destiné à ce contrôle. En dehors d'un petit nombre d'employés, de la discrétion desquels le directeur devra pouvoir répondre, il y aura un ou des médecins enquêteurs.

La déclaration des cas sera faite par les médecins traitants indemnisés; des formules simples seront tenues à leur disposition par le bureau d'hygiène. Le classement des cas déclarés sera fait sur deux sortes de fiches:

1°. Un classement d'après le nom du malade, qui permettra de se rendre compte si un cas déclaré nouvellement a été l'objet d'une déclaration antérieure.

2°. Un classement par adresses, qui permettra d'établir l'état sanitaire de chaque immeuble.

L'enquête faite par le médecin du bureau d'hygiène devra porter sur les conditions de salubrité de la maison qu'habite le malade, sur la profession de ce dernier, sa famille, sur l'atelier ou le magasin où il est employé.

A la sortie de l'hôpital ou du sanatorium, le malade sera à nouveau l'objet de fréquentes visites de la part des inspecteurs sanitaires qui noteront son état de santé, son occupation actuelle, et l'état sanitaire de l'immeuble qu'il occupe.

Ces enquêtes, enfin, étudiées avec soin au bureau d'hygiène, donneront lieu à un rapport qui permettra de pratiquer les désinfections nécessaires et de mettre le malade en communication avec les institutions que nous avons énumérées et qui constituent le système antituberculeux.

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[1] Voir pour plus de détails: La lutte contre la tuberculose dans le Royaume-Uni, par m. Dr. Guerbet, Jouve édit., Paris, 1911.

A STUDY OF THE OBSERVATION AND ENFORCEMENT OF A STANDARD TUBERCULOSIS REGISTRATION LAW.

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It was my privilege, during the early months of the current year, to visit the cities of New York State, exclusive of New York City, and observe the enforcement of what is known as the tuberculosis registration law.

This law was enacted by the legislature of 1908, and had been in effect practically four years; one of the purposes of my trip being to determine in what manner, if any, I thought the law might be improved.

Briefly, this law declares tuberculosis to be "an infectious and communicable disease dangerous to the public health," and makes

it "the duty of every physician in the State to report in writing" to the health officer, on a special form, "the name, age, sex, color, occupation, place where last employed, if known, and address of every person known by said physician to have tuberculosis, within 24 hours after such fact becomes known to said physician." It provides for the free examination of the sputum of a person having symptoms of the disease; that all records of the reports of cases and the results of sputum examinations shall be kept secret; for the disinfection, cleansing or renovation of premises after the death or removal of one sick with the disease, and for the report of the change of residence of all tuberculous persons. It further prohibits the careless expectoration of tubercular persons, declaring the same to be a nuisance, and provides for complaint against them, and for their punishment if the complaint is proved. A blank is provided for a statement of the procedures and precautions taken with and on the premises of the patient by the physician in attendance, a penalty is provided for the false report of a case, and various other penalties are provided for the nonobservance of the law.

Advance notices of my coming were sent to the health officer and the president of the board of health or commissioner of health in each city, and on my arrival I reviewed the situation with the health officer, going over the observation of the law in his community and suggesting changes where necessary.

I reported my findings to the commissioner of health or president of the board of health in each city, and in many met the board of health and reported to them also.

I also pointed out what I thought was the special need of each community for a fuller observation of the law and more effective control of the disease.

In many cities I met the physicians and discussed with them the various sections of the law and the need for their observation. I found some opposition on their part, resulting in almost every instance from a misunderstanding of the law, and after clearly explaining the various sections and pointing out the necessity for them, a marked improvement was noted.

Briefly, my findings placed the cities in three great classes, as follows:

First. Those few cities in which the law was strictly observed both in letter and in spirit, and in which the work by the municipality against this disease was progressing in a very satisfactory manner.

Second. Those cities in which the law was observed in a greater or lesser degree, the importance of its provisions being only partly appreciated.

Third. Those cities, and there were several of them, in which the law was scarcely observed at all or, at most, indifferently.

I found that, as a rule, the larger and more progressive the city the better the law was observed, but there were notable exceptions to this, the health authorities of one of the largest cities having apparently never heard of one of the chief provisions of the law.

A brief résumé of my findings, arranged in the order of the sections of the present law, may be of interest:

SECTION 1.—*Reports of cases.*

More cases than deaths were reported each year in only 9 cities; more cases than deaths were reported for the entire 4 years in only 20 cities; more deaths than reported cases had occurred during the 4 years in 26 cities.

SECTION 2.—*Examination of sputum.*

Free examination of suspected sputum was offered in every city, the examinations being made in some instances by the city, in some by the county, and in the remainder by the State.

SECTION 3.—*Protection of records.*

(*a*) In every city reports of cases were kept by the health officer in a secret register.

(*b*) In most cities the records of the results of sputum examinations were also kept, but in a few this was not so.

SECTION 4.—*Disinfection of premises.*

(*a*) Notification of every death. In all but four cities the health officer was promptly notified of every death from this disease.

(*b*) Notification of change of residence. In most cities these were very seldom received; rarely from physicians, occasionally from tenants wishing to move into a house, or from the owner, but no record of such a report being received from a lessee or occupant was found. In cities where there were special nurses for tuberculosis the largest number of these reports were received.

(*c*) Reoccupation of premises after death. In no case where the health officer had been notified was this allowed until the premises had been thoroughly disinfected, cleansed or renovated; but in several places such premises were reoccupied without this being done, because the health officer had not been notified of the death at the time.

(*d*) Reoccupation of premises after change of residence. In no case where the health officer had been notified was this allowed, but most were reoccupied without disinfection, cleansing or renovation, because so few reports of such changes were received.

SECTION 5.—*Health officer to direct disinfection, cleansing or renovation.*

(*a*) Determination of manner of disinfection. When notified of the death or change of residence of a tuberculous person, the health officer determined the manner in which the premises should be disinfected, cleansed or renovated in every instance.

(*b*) When disinfection alone is sufficient. This was done at the expense of the city in every instance.

(*c*) When cleansing or renovation is determined necessary. This was seldom so; but when it was the owner was usually asked and, by a few, directed to do it at his own expense.

SECTION 6.—*Prohibiting occupancy until the orders of the health officer are obeyed.*

(*a*) Placarding of premises. This is seldom done, as the owner usually obeys the second notice if he does not the first. Many cities reported this never necessary. Buffalo, however, finds it necessary, and frequently placards premises.

SECTION 7.—*Prohibiting carelessness of a person having tuberculosis.*

(*a*) Complaints of careless cases. Many cities have received such complaints, but usually only few of them.

(*b*) Investigation of complaints and service of notice when necessary. Some health officers investigate these personally, some turn them over to an assistant or sanitary inspector; and others ask the local tuberculosis nurse to investigate. Very few health officers have served any notice in these cases. A few have cautioned the patient, but that is all.

(*c*) Prosecution. In no instance was a single prosecution reported. In some instances this was reported as never necessary.

SECTION 8.—*Protection of patient's family.*

(*a*) Performance by health officer of duties of physician in case no physician is in attendance. Most health officers reported that they performed all duties of physicians in cases in which they knew no physician was in attendance. Many stated that they did not know of any such cases. Several turned these cases over to the care of the city physician, and others referred them to the tuberculosis nurse.

(*b*) When a physician reports he has failed to perform such duties. Very few of these cases were noted. It was reported that in such cases the health officer looked after the patient himself or saw that it was done by a deputy, the city physician, or a special tuberculosis nurse.

SECTION 9.—*Providing that physicians shall make a complete statement of procedures and precautions on a blank to be furnished by the health officer.*

(*a*) Supply of blanks on hand. The health officers of six cities had apparently never heard of such blanks and had no supply on hand. All other health officers had a more or less complete supply on hand.

(*b*) Transmission of blanks to a physician reporting a case. Most of the cities that had blanks sent one to the physician reporting each case in almost ever instance, a few sending them in every instance. Several health officers, thinking the blanks of little service, sent them only occasionally, and many spoke emphatically of the impracticability of the present blanks and their utter uselessness.

(*c*) Filling out of blanks by physicians. On the receipt of such blanks most physicians filled them out in a perfunctory manner and returned them to the health officer. Most of them reported that they were willing and able to carry out the procedures and precautions specified, even though they did not fill out the blanks completely. Many physicians criticized the blanks severely, saying that it was impossible to fill them out satisfactorily.

(*d*) Duties of health officer when physician reports he is unwilling or unable to supervise the case. All health officers reported that in these instances they supervised the cases themselves or had the city physician or a nurse supervise them.

(*e*) Return of blanks with additional instructions. In a few cities unsatisfactorily filled out blanks were returned to the physician with additional instructions; but in most places this was not done. In some cities blanks that were sent to the physicians for filling out were in several instances never returned. A few cities follow up the physician with requests for the return of these blanks, but most cities do not.

(*f*) Sending of requisition blanks for supplies. Most cities send requisition blanks for supplies to each physician reporting a case; but many do not, because they have never had any supplies on hand.

(*g*) Furnishing of supplies. A large number of cities keep sputum cups and holders on hand and supply them freely on requisition by a physician and in many instances by a nurse. A few cities have paper napkins, liquid disinfectant, and pocket pouches also, but most do not. Several cities furnish no supplies at all.

(*h*) Requests by physicians for supplies. In most cities where supplies are kept on hand the physicians avail themselves of them to some extent, but usually only for a short time for each case. Nurses, however, frequently request supplies for the same patient for a long period of time, and in a few instances patients and friends of patients request them.

(*i*) Supply and use of circulars of information. Every health officer reported that he had a full supply of circulars of information published by the State department of health or locally and that he either sent one to every physician reporting a case or to the patient. Several cities have these circulars printed in foreign languages also.

(*j*) Payment of $1 fee for filling out procedures and precautions blank. Comparatively few cities pay this fee. Many cities and most physicians seen did not know there was a fee allowed. A few cities refrained from paying it, on account of the expense, and one city absolutely refused to pay it.

Section 10.—*Reporting recovery of patient.*

In most cities not a single report of the recovery of a previously reported case had ever been received. Some recoveries of unreported cases had been noted, however, in a few places. Buffalo reported many recoveries of reported cases, and there all reported cases are closely watched until recovered, dead, or removed from the city. In the last instance, the health officer of the place to which they move is notified of the case, if the locality can be ascertained.

Section 11.—*Penalties.*

(*a*) For knowingly reporting as tuberculous any person not so affected. No instance of this was reported. In fact, nearly every report was of an advanced case. The few exceptions to this were in the largest cities, where the disease was frequently recognized reasonably early, and, in a few instances, very early.

(*b*) For making false statements regarding a case or certifying falsely as to any of the precautions taken. No instance was found of any physician making any false statement regarding a case, nor reporting falsely as to any of the precautions taken.

(*c*) General penalty for violation of any of the provisions of the act. No report of the prosecution of any person violating any of the provisions of the act was noted.

CONCLUSIONS.

After a careful consideration of the observation and enforcement of the above law in particular, and of the laws of several other States in general, I have reached the following conclusions:

That a tuberculosis law, to be effective, must place in some central authority, as the State commissioner of health, full power and means to enforce its every provision, together with specific statements directing that authority so to do.

That this authority be directed to make rules and regulations from time to time for the care of persons suffering from tuberculosis and for the prevention and more effective control of the disease.

That these rules shall state strongly the seriousness of the problem, the contagiousness of the disease, and the like, with a view to impressing upon the general public, and particularly the local public health authorities, the need for larger appropriations and more effective measures against it. Let these rules state that the control of tuberculosis in any community is not only a humanitarian proposition, but also, and in an even larger measure, a business proposition for that community. That the welfare and prosperity of every city depends fundamentally upon the health of its citizens, and that a thoroughly efficient health board is of far greater value and should be more liberally supported than either the fire or police department.

I believe that the responsibility for securing the report of all cases of tuberculosis in any community should be fixed upon the local health authorities, exclusive of the health officer, and that the State commissioner of health be given power and directed to enter into any community in which the reports of these cases are not secured and secure such reports, and that the expense of the work be a charge upon that community.

That the report of a case be made as easy as possible, every physician being required to report, by telephone, in person, or by mail, simply the name and address of the patient, and of the physician in attendance.

That the laity be permitted and urged to report suspicious and known cases, I would also advise, as then many cases not now reported would be. The keynote of the ultimate control of this disease is, first, in knowing where the cases are, and all active control depends primarily upon this. The importance of securing an accurate record of every case can not be overestimated. Especially should householders, heads of families, lessees, owners or occupants of premises, or employers, where such a case lives, or works, or spends his leisure, be permitted and urged to report it.

I believe that every city and every county should be required to provide a special nurse for tuberculosis for every 50 cases or fraction thereof, and that the instruction and supervision of the patients be done by them with the consent and under the direction of the physician in attendance. These nurses should be required to first visit the physician in attendance, if any, and secure his consent. If this is granted, I would relieve the physician from any responsibility as to the prevention of the spread of the disease from that patient, but, if he fails to grant this consent, I would hold him responsible for the control of the contagion of that case, and require him to report at least quarterly and in detail concerning the measures that have been taken to prevent the spread of the disease.

I would urge that a sufficient number of competent diagnosticians be provided throughout the State, to whom a person thinking he may have the disease may go at no expense, or to whom a physician or a nurse may refer a case for diagnosis.

That the freer use of sputum examinations as a confirmatory measure should be advised and, where the first specimen is found negative, that it be reported as unsatisfactory and additional specimens requested.

I believe the health officer should be notified, not only of the change of residence and death of every person having this disease, but also of the change of place of employment of every such person.

That a space be set aside upon the blank form of every death certificate, and the physician last in attendance, or the health officer, be required to state thereon whether the patient had or had been thought to have had tuberculosis at any time during the last two years of his life.

That all infected premises made vacant by change of residence, change of place of employment, or death of any person having this disease shall be disinfected, cleansed or renovated by the health authorities, or by the owner or agent. If the premises so vacated are not disinfected, cleansed or renovated within 48 hours, I believe the health authorities should be directed to place a placard upon them, forbidding their occupancy until put in a proper sanitary condition.

That all health officers should receive additional compensation, in addition to their regular salary, for all work done by them against this disease, seems no more than right, and is admitted by most sanitarians.

I strongly believe that the time has come when every careless case should be instructed and warned and, if still persistently careless, should be forcibly removed and detained until such time as, in the opinion of the health authorities, the case may be allowed his liberty with safety to the community.

CERTAIN IMPORTANT FEATURES OF THE CONTROL OF TUBERCULOSIS.

Bertram H. Waters, M. A., M. D., of the Department of Health, New York City, Division of Communicable Diseases.

Prevention of tuberculosis, the greatest world movement of modern times, originating in various countries from the same impulse, the epoch-making labors of Robert Koch, has, in each, proceeded along fairly uniform lines. The importance of the dispensary, the sanatorium, and the hospital has been established, and, in this country especially, this organization has been built upon the cornerstone of registration of the disease and its sanitary supervision.

This procedure has been made compulsory without serious opposition on the part of either physicians or patients, and has proved efficient to a high degree. By means of it and a well developed and organized group of free dispensaries tuberculous individuals of the dispensary class are kept under surveillance which is as adequate as can be expected in a large city. The most important factor contributing to the shortcomings of registration is the very appreciable percentage of those patients who give false addresses or who remove to new ones without notification of the department of health—often with the intent to escape its supervision—together with those living in lodging houses and those actually homeless, all collectively being known as "not found cases." This group, in 1911, constituted fully 25 per cent of all reported cases, and while it is entirely within the powers of the department to place the responsibility of reporting removals of consumptive's upon the owners of tenements or their agents, and such a procedure has been considered at various times, this action has never been taken because of its severity and the hardship its rigid enforcement would entail. However, even with this number of unsupervised cases, it would seem that a review of the city's statistics during the years since registration and sanitary supervision became fully operative should disclose some evidence of its efficiency as shown by an actual diminution of the prevalence of the disease. There has been a very gratifying reduction in the tuberculous death rate, and a comparison of this with the general death rate for a corresponding period shows that the former has fallen considerably more rapidly and appreciably.

TABLE I.

Year.	General death rate.	Death rate: Pulmonary tuberculosis.	Year.	General death rate.	Death rate: Pulmonary tuberculosis.
1900	20.57	2.37	1906	18.35	2.16
1901	19.91	2.29	1907	18.76	2.10
1902	18.58	2.07	1908	16.52	2.01
1903	17.96	2.12	1909	16.23	1.89
1904	19.99	2.18	1910	15.98	1.81
1905	18.31	2.12	1911	15.13	1.76

This would indicate that the tuberculous death rate has been lowered, not only by improved hygiene, the enforcement of general sanitary measures, and other factors operative upon the general death rate, but also by other influences which may fairly be considered to be the special efforts which have been so well directed against this disease itself.

If, however, a study is made of the number of tuberculous persons reported in the city yearly during the last decade, with due regard to the percentage rate of increase of the metropolitan population, and with the fair assumption that during this period compliance with the requirements of registration has been normally efficient and uniform, it seems that there may have been an actual increase in the prevalence of tuberculosis, or at least that it has not been materially diminished.

TABLE II.

Year.	New cases pulmonary tuberculosis reported.	New cases pulmonary tuberculosis per 1,000 of population.	Year.	New cases pulmonary tuberculosis reported.	New cases pulmonary tuberculosis per 1,000 of population.
1900	11,977	3.48	1906	20,085	4.84
1901	13,397	3.77	1907	19,725	4.60
1902	12,346	3.37	1908	23,325	5.27
1903	15,214	4.02	1909	25,667	5.62
1904	18,723	4.80	1910 [a]	32,065	[b] 6.67
1905	20,831	5.18			

[a] Marked increase probably due to extension of dispensary work.

[b] For 1911 this percentage is 4.92. Decrease probably due to extension of supervision by nurses.

Unquestionably one of the reasons for this may be found in the lack of adequate hospital accommodation for advanced and "open" stages of the disease in a class of persons who rarely obtain permanent improvement, who usually are dependent, and who frequently are homeless and depraved.

All our efforts for prevention, especially those of the last decade, have, with ever-increasing assurance, demonstrated the urgent necessity for the proper management of "open" stages of the disease, and segregation, for such patients as are dependent, is not only indicated as the one sure and safe measure, but also is meeting with less sentimental opposition. In our large cities, where the enforcement of such a measure is most needed, lack of adequate hospital accommodation for these patients has retarded the development of public sentiment in its favor, and has made its accomplishment impossible even in a minority of instances. There are, as a rule, too few beds to accommodate those who would willingly accept hospital care. New York City has at present 2,635, to which during 1911 there were 16,901 admissions, representing at least 12,500 different patients. Of these, 5,705 were homeless and 50 per cent of all applicants could only be placed upon a waiting list. It is apparent, then, that for these patients with advanced disease, of whom the majority, at least, require and would gladly accept hospital care, no immediate or adequate provision can be made. Even when the hospitals contemplated or in course of construction are available there will still remain a probable shortage of from 2,500 to 3,000 beds. In other words, there will be in their homes, for the most part already unsanitary enough, this number of tuberculous persons who have or will have bacilliferous sputum, and are therefore the source of infection of those about them. While popular education is accomplishing much in inducing such consumptives to take proper precautions to prevent this, we can not, and probably never will, entirely succeed in making them, as a class, careful and therefore safe. Failure to provide adequately for them seems to be false economy, and to needlessly defer the realization of our hopes for the eradication of the disease.

That New York is not unique in this respect is shown by the following table:

TABLE III.

	Hospital beds.	Total tuberculosis deaths.[a]
New York [b]	2,635	10,127
Chicago [c]	695	3,908
Philadelphia [c]	664	3,371
Baltimore [c]	260	1,404
Boston [c]	585	1,379
St. Louis [c]	202	1,275

[a] Bulletin 109, Bureau of the Census, Mortality Statistics for 1910.

[b] Ascertained by a questionnaire sent out this year by the Committee on the Prevention of Tuberculosis of the Charity Organization Society.

[c] Estimation made by the National Association for the Study and Prevention of Tuberculosis for 1911.

For adequate hospital control there is required, not only sufficient hospital accommodation, but also authority for compulsory removal and detention. All cities and towns which, by sanitary ordinance of the proper health officers, have declared tuberculosis to be a reportable and communicable disease have, or should have, this authority, and, under proper conditions, should exercise it. There are many patients who should be in a hospital who obstinately refuse the privilege of admittance thereto and who frequently are notoriously indifferent in the observance of precautions and to the welfare of those about them in their own unsanitary homes or elsewhere. These should be compelled, by force if necessary, to enter a hospital and should be detained there permanently if need be, or certainly until there is good evidence that they are themselves amenable to sanitary regulations and that they can be properly cared for by those upon whom they are dependent. This procedure was adopted by the division of communicable diseases of the Department of Health of New York, in 1905, and no question as to its propriety or legality has been raised. Frequently, however, there has been no room, even for this class of patients, in the department's hospital, at Riverside, where only, under the present system, they may legally be detained. Whenever this authority has been exercised removal has been justified by the following conditions, which inspection has verified:

1. Tubercle bacilli present in the sputum at a recent (six weeks) examination.

2. Lack of observance of sanitary precautions.
3. Insanitary condition of the home.
4. Helplessness, or dependency upon the family of the patient.
5. Presence of others in the home, especially children, exposed to infection.

These requirements, however, are not sufficiently stringent, are not applicable to many patients who should be under control, and rest upon the unscientific assumption that a patient with nonbacilliferous sputum is negligible as a source of infection. It is highly probable that the absence of bacilli is frequently the result of a too hasty and incomplete search and that the newer and more refined methods of examination will demonstrate their presence in a great number of instances, and it is certain that the "closed" lesion may at any moment become an "open" one; moreover, the experience of social service and charity workers, whose aid is an indispensable factor in the tuberculosis problem, testifies to the frequency with which the financial burden of the patient at home demands the labor of the wife or children, or, even with this, forces the family to seek charitable aid. When there is added to this miserable situation drunkenness of the patient, or the violence and drunkenness of the husband when the wife is the patient, it becomes intolerable. It is contrary to all economic and philanthropic standards that, under such circumstances, the patient should be left in the home, and that either public or private funds should be employed to maintain it.

Universal segregation, ideal though it may be, is at present impracticable, but it is gratifying to those unselfishly interested in public-health matters that patients, however invalided, unable to provide themselves with proper care and comfort in their homes are becoming less averse to entering hospitals. This attitude should be encouraged, especially for the tuberculous, and the most effective means of allaying their apprehension, of really giving them better care and of encouraging them to remain in hospitals, will be the provision, even at a cost above that of the present, of modern wards, good food, and efficient, sympathetic attendance. Too often we are shortsighted in our ideas of hospital economy and indifferent in the selection of our hospital attendants.

The hospitals of the future, in which patients with advanced disease will be segregated, will be near the large centers of population, not in them, and accessible to relatives and friends. They will have ample and attractive grounds, to which patients will willingly restrict themselves. They will supply their inmates with good food, not the cheapest purchasable, and the atmosphere will be that of the home and sanatorium, not of the hospital. Thus shall we help to solve two of our problems—the proper care of infectious cases and its cost.

Another problem, the solution of which becomes each year more essential, and which presents many difficulties, is the post-sanatorium management of arrested cases, including the closely related one of their proper employment. There is, thanks largely to our efficient campaign against tuberculosis, a very pronounced popular sentiment, amounting in many instances to a veritable phthisiophobia, against the employment of the cured tuberculous individual. In the future, it will certainly be the duty of all those interested in tuberculosis work to counteract this, and to teach that such persons are not a menace to the health of their associates, and that it is inhuman to deprive them of suitable employment. It would be proper, and should be possible in all communities, to make reexaminations of all patients returning from public sanatoria, upon the result of which certificates should be made of the patient's recovery, and of the fact that infection was no longer to be feared, which would be satisfactory to employers and fellow employees. One method of dealing with this important matter, which as yet has not received the attention it deserves, is the organization of industrial colonies, preferably in the immediate vicinity of the sanatorium, where patients with arrested lesions may be employed, either in their own occupations, or one newly acquired, the products of their labor being used in the institution itself or in others under municipal control. Our older views of entire rest as an essential factor in sanatorium régime have so largely yielded to graduated, supervised exercise in useful employments that in many institutions, notably the sanatorium of New York City, at Otisville, a great part of the requisite daily labor, indoors and on the grounds, is performed by patients, to their great benefit, and to the very considerable economic gain of the institution.

The control of tuberculosis is not entirely a sanitary problem, in any community, and it is impossible to deal adequately with it unless there is efficient cooperation between wisely directed charities and the sanitary authorities. Happily, in New York, important organizations, such as the Association for Improving the Condition of the Poor, the United Hebrew Charities, and the Charity Organization Society, have from the very beginning of antituberculosis work been in cordial sympathy with the city's efforts, and in every way most helpful. Very recently, moreover, in response to the needs of the special tuberculosis dispensaries there have been formed for a number of them associations of philanthropic women, known as dispensary auxiliaries. Using the dispensary as a district center, and with all its medical and sanitary resources at their disposal, a very important step forward has been taken in intensive neighborhood betterment work, and in fostering the intimate personal relation between dispensary and patients which is so essential to the success of the former and the confidence and real physical and material benefit of the latter. By reason of their unofficial character, they are able to undertake relief work which is prohibited to dispensaries under municipal control. Even in those of private character and maintenance, where such limitations do not obtain, the very best results have followed the organization and development of such social service work by auxiliary associations.

The pioneer in this broader field of tuberculous dispensary service was the trained nurse or lay visitor to the homes of patients. She has become an indispensable factor in this phase of the general problem, and is destined to assume an ever-increasing responsibility.

Dispensaries and auxiliaries are in the future to undertake, far more than in the past, trained nursing, in its broadest and best conception of that profession, in the homes of these patients.

DISCUSSION.

Dr. HERMANN M. BIGGS spoke of Wilton's mortality curve and its incorrectness, as exemplified by the figures available from New York City, where, with about 9,000 deaths annually, there are about three times that number of consumptives under observation. He did not believe that it was possible at the present time thus to accurately construct a mathematical formula to show the number of living tuberculous individuals, for there was no doubt at all that the average length of life of consumptives has materially increased in the past few years. Aside from this, he entirely agreed with Dr. Smith, and could not help but admire the excellent organization described.

In New York State the work of the State Charities Aid Association had covered the State with organizations in villages, towns, and counties. Dr. Biggs agreed heartily with the conclusions presented by Dr. Prest, though he felt that some of them would not be carried out for some years.

In closing, Dr. Biggs described a type of pavilion to be used interchangeably for tuberculosis and other infectious diseases.

DIE ROLLE DER LYMPHATISCHEN KONSTITUTION IN DEN INFEKTIONSKRANKHEITEN.

Dr. S. VON UNTERBERGER, St. Petersburg.

Neuerdings rückt die Frage der Bedeutung konstitutioneller Momente wieder etwas mehr in den Vordergrund. Zumeist bildete Kasuistik interessanter Fälle den Ausgangspunkt zu Studien in dieser Richtung und hat mancher bedeutende Autor, aus langvergangener Zeit, seine reichen Erfahrungen und persönlichen Eindrücke in sehr

beachtenswerten Ausführungen niedergelegt. Ich will nur an Rokitansky und Virchow erinnern. Tragen die Ausführungen dieser Autoren ein stark teoretisches Gepräge, so zeigte Benecke, dass man auf Grund systematischer Untersuchungen gewisse, fast gesetzmässige Verhältnisse feststellen könne, welche für die Bewertung der in Rede stehenden Fragen von grosser Bedeutung sein müssen.

In der Wiener Schule, unter Weichselbaum's Leitung sind, in letzter Zeit solche systematische Untersuchungen in Angriff genommen worden, um in Anknüpfung an bewährte Autoren einen gangbaren Weg zu finden zur Klärung konstitutioneller Fragen.

Die neueren Untersuchungen der Wiener Schule, namentlich die Arbeiten von Prof. Bartel, stellen nun einen Versuch dar, durch Zusammenstellung systematisch erhobener Befunde von verschiedenem Gesichtspunkte, einige Ordnung in vielfach schon vorhandenen Vorstellungen über die Bedeutung konstitutioneller Momente, zu bringen und haben dabei neben allgemein als "Krankheit" und "krankhafte Zustände" anerkannten Prozessen auch anderen Befunden bei Obduktionen Aufmerksamkeit geschenkt, so in erster Linie den Erkrankungen des Lymphsystems, welches in der Mehrzahl der Fälle, als Nebenbefund sich herausstellte und somit in enger Beziehung mit dem schweren Verlauf der Krankheit in Verbindung gebracht werden könne.

Wenn wir jetzt von einer lymphatischen Konstitution sprechen werden, so wollen wir uns zuvor Klarheit zu verschaffen suchen, was man unter diesem Begriff zu verstehen hat.

Paltauf's Definition eines charakteristischen Bildes des Status-thymico-lymphaticus lautet: Blässe der Häute, wohl entwickelter panniculus adiposus, Hyperplasie der verschiedenen Teile des lymphatischen Apparates, der Lympfdrüsen des Halses, der Axilla, des Mesenteriums, des Follikel des Nasenrachenraumes, der Darmwandungen, des Zungengrundes; die Milz stark vergrössert, Thymus über mittelgross. Diese aufgezählten Befunde führen uns dahin, sagt Paltauf, einen allgemeinen krankhaften Zustand des Körpers anzunehmen, der durch die Bezeichnung lymphatische Konstitution am ehesten gekennzeichnet wird.

Bis zu diesem exklusiven Bilde in der grossen Gruppe des Lymphatismus sind nun verschiedene Bilder der Schwellungs- und Veränderungszustände, angefangen von vereinzelten Teilen in den verschiedensten Abschnitten des komplizierten lymphatischen Apparates. Bald treffen wir sie in einem Lungenlappen, nicht selten durch Generationen hindurch, bald zerstreut in verschiedenen Lappen. Aehnlich verhält es sich ja mit der Arteriosklerose. Die Pulsuntersuchung zeigt in den meisten Fällen den arteriocklerotischen Prozess, aber wir wissen, dass bei intakter Radialis andere Arterienbezirke erfasst sein können, bald in den Lungen, bald im Herzen, bald im Gehirn u. s. w. Ferner wissen wir, dass durch Generationen in einzelnen Familien Hirnapoplexien, in anderen Herzsklerose, sich vererbt, oder richtiger gesagt die Anlage zu dieser Krankheit.

Bezüglich der Ursachen der lymphatischen Konstitution kann man in zahlreichen Beobachtungen und Ansichten früherer Autoren manche beachtenswerte Anhaltspunkte gewinnen. Im allgemeinen dürften sie wohl in der Ursache der Degeneration des Menschengeschlechts zu suchen sein. So muss man bei den oft beobachteten angeborenen Anomalien gewiss schon auf die Möglichkeit einer kongenitalen Anlage schliessen. Besonders beobachtenswert erscheinen wohl Infektionskrankheiten, und da wiederum namentlich die Tuberkulose und Lues.

"Es steht durchaus nichts der Annahmen im Wege" sagt Orth, "dass die kongenitale Anlage erst im Laufe der allgemeinen Körperentwicklung, vielleicht gar erst während der Pubertätszeit, zur Ausbildung gelangt, in derselben Weise, wie die Entwickelung des Bartes, des Kehlkopfs, der Brüste, der Geschlechtsteile etc., die doch auch auf Vererbung beruht, erst lange nach Geburt vor sich geht." Mit der Annahme einer solchen konstitutionellen Anlage, wird aber keineswegs etwas Neues und Unerhörtes in die Pathologie eingeführt, sondern wir schliessen damit z. B. die Tuberkulose resp. Phthisis nur anderen bekannten Krankheiten an.

Jüngst noch schreibt der bekannte pathologische Anatom von Hansemann in seiner hochinteressanten Arbeit über konditionales Denken in der Medizin, dass die Disposition keinen vagen Begriff darstellt und etwa nichts anderes bedeuten soll, als aufgehobene Immunität. Disposition bedeutet immer einen ganz bestimmten Zustand des Körpers. Wir sehen wie bei chronischer Schwindsucht die T.-Bazillen immer weiter sich verbreiten, sogar auf der Haut Tuberkulose sich zeigt, wie kann man da von einer Immunität sprechen. Jetzt ist schon konstatiert, dass bei künstlich tuberkulisierten Tieren Reinfektion erzeugt werden kann.

Schon Hufeland sagt: Durch die Zeugung gehen nicht bloss wirkliche Krankheiten, sondern mehr noch die Anlage zu Krankheiten über, die sich dann erst im Laufe des Lebens in gewissen Entwickelungsperioden oder unter begünstigten Umständen offenbaren und zu wirklichen Krankheiten ausbilden. Dahin gehören die Anlage zu Lungensucht, Gicht u. s. w.

Die Lebensversicherungs-Statistik spielt bei der Beurteilung dieser Frage gewiss eine hervorragende Rolle, denn sie lässt sich nicht von tendenzioser Einseitigkeit und von Moderichtungen—wie sich Martius sehr richtig ausdrückt—beeinflussen, für Sie hat nur das Wert, was praktisch als sicher festgestellt ist, um ein gutes Geschäft zu machen. So erklärte Oldendorf, dass "als ätiologisches Moment bei der Phthisis die hereditäre Disposition in den Vordergrund trete, während die Gefahr der Ansteckung nur als eine sehr geringe zu betrachten sei. Ebenso lässt sich nachweisen, dass vorausgegangene Skrophulose zur Lungenschwindsucht in hohem Grade disponiert.

Genaue wissenschaftlich verwertbare Daten in dieser Frage, die sich auf 50 Jahre erstrecken, sind von Haegler veröffentlicht worden. Die Zahlen aus diesen Berichten sprechen eine um so deutlichere Sprache, wenn man denkt, dass es sich um "auserlesene Risiken" handelt, dass ferner die Aufnahme erst nach Ablauf desjenigen Alters erfolgte, in welchem nach früherer Ansicht, die phthisische Heredität sich geltend macht, und dass endlich die Tuberkulose anderer Organe nicht miteingerechnet ist.

Die grosse Bedeutung des Energiegesetzes in der Pathogenese der Krankheiten ist jetzt überall anerkannt und klärt so manches Widersprechende auf. Das Wesen einer Krankheit kann man nicht mehr im alten ontologischen Sinne suchen, die moderne Anschauung stützt sich auf das Gesetz der Erhaltung der Kräfte. Die Ursache einer Krankheit besteht aus zwei Komponenten: aus den auslösenden (Mikroben, Gifte) und auszulösenden (körperliche Anlage) Kräften. Beide Komponenten stellen variable Grössen dar. Die auslösenden Komponenten aber können nur da im Organismus eine Krankheit hervorrufen, wo die Anlage zu dieser Krankheit dazu vorhanden ist. Die Anlage besteht somit nicht in einer allgemeinen Gewebsschwäche, sondern in einer spezifischen. Vollkommen klar sprechen dafür die Bazillenträger. Das Blut eines Menschen kann mit Tuberkel-, Typhus-, Cholerabazillen angefüllt sein und der Mensch erkrankt nicht. Und warum? Weil eben in seinem Organismus nicht die spezifische Anlage zu der Krankheit vorhanden ist. Warum z. B. erkranken Säuglinge bis zu ihrem zweiten Lebensjahre nicht oder im Ausnahmsfalle an Tuberkulose oder Cholera, wenngleich sie auch von phthisischen oder cholerakranken Müttern geboren? Weil die spezifische Anlage sich bei ihnen nocht nicht gebildet hat, um mit den entsprechenden Mikroben eine Krankheit hervorzurufen.

Wenn auch die Infektionstheorie viel bestechendes hat, so sehen wir, dass zu allen Zeiten die Hereditätsfrage immer auftauchte. Von Hippokratus Zeiten an bis in die Neuzeit finden wir unter den Infektionisten und Hereditariern hervorragende Heroen der Wissenschaft.

Es ist aber erst der Neuzeit vorbehalten gewesen die scheinbar widersprechenden Anschauungen der Infektionisten und Hereditarier in Einklang zu bringen. Es besteht nämlich nach dem Energiegesetz, und den neuesten biologischen Forschungen zwischen den beiden Lagern kein wesentlicher, sondern nur ein gradueller Unterschied; entweder sind die Keime stark entwickelt oder stark entwickelt ist die Anlage. Ohne Keim oder Gift und ohne Anlage gibt es keine Krankheit. Daher müssen wir stets im Auge behalten, dass manche Mikroben den Menschen gegenüber sich generel, manche nur individuel verhalten, d. h. für einige Mikroben wie für die des Flecktyphus, Pocken, Pest und vielen anderen, sind fast alle Menschen veranlagt, für andere, wie den Tuberkel- und Leprabazillus nur die Menschen, die die Anlage durch Vererbung besitzen.

Welche von den Krankheiten finden wir nun in engster Beziehung mit der lymphatischen Konstitution? Es ist das unstreitig in erster Linie die Tuberkulose und speziell die Schwindsucht; letztere interessiert ja am meisten den praktischen Arzt, da von 12 verstorbenen Tuberkulosen 11 an Phthisis gelitten. Weiter finden wir in 70–80 Prozent von Sterbefällen an Masern, Scharlach, Pocken, Diptherie und Cholera den Lymphatismus als deletär wirkendes Moment.

Ueberall wo eine Hyperplasie im Gebiete des Lymphapparats an irgend einem Teile der Gefässe oder der Drüsen sich entwickelt, sei es in den Lungen, sei es in den Unterleibsorganen, sei es im Gehirn, Knochen u. s. w., so ist dieselbe in der überwiegenden Mehrzahl biologisch-chemisch zur tuberkulösen Anlage umgewandelt und somit zum geeigneten Boden geworden für Ansiedlung der Tuberkelbazillen und weiterhin zur Krankheit, die man Tuberkulose resp. Schwindsucht nennt.

Die lymphatische Anlage kann zugleich vererbt sein mit Anlagen zu anderen Krankheiten wie z. B. zu Leber, Nieren, Darmleiden u. s. w. Wenn somit Lobpreisungen eines Mittels bei der erfolgreichen Behandlung der Schwindsüchtigen berichtet werden, so müssen wir es so erklären, dass die Mittel bei einer ganzen Reihe von Kranken auf die Beseitigung einer bestimmten Krankheit oder Krankheitsanlage günstig eingewirkt haben, wodurch der Organismus so weit gestärkt wurde, um die Schwindsucht mit Erfolg zu bekämpfen. Natura sanat, medicus curat. Auf diese Weise erscheint die Schwindsucht als sehr kompliziertes Bild und deshalb ist der Erfolg bei der Behandlung nie vorauszusehen.

Zu diesen theoretischen Auseinandersetzungen bietet das Alltagsleben zahlreiche Beispiele. Den schlagendsten Beweis liefern wohl die zahlreichen Familien in den Dörfern, in denen z. B. neben einer Anzahl frühzeitig verstorbener schwindsüchtiger Kinder, einzelne vorhanden, die ein höheres Alter erreichten und an Marasmus starben. Alle haben die ersten Jahre unter denselben Bedingungen verbracht, den Winter in der engen, nie gelüfteten Bauernstube, in der günstigenfalls ein mit Sand gefüllter, hölzerner, aber nicht ausschliesslich benutzter Spucknapf stand, und das ganze Jahr in nächster Nähe, oft am Bett der schwindsüchtigen Mutter oder des Vaters. Und trotz dieser äusserst intensiven Infektionsmöglichkeit sind einige gesund geblieben und alt geworden (Riffel). Zahlreiche Frauen, die aus gesunden Familien stammend, einem schwindsüchtigen Manne Kinder gebaren, sie pflegten, oft bis zum Tode und darnach uralt wurden und gesund geblieben. Sie teilten die Bedingungen mit den Kindern, diese aber, vom Vater aus erblich belastet, erlagen der Schwindsucht, während die Mutter, obgleich der Infektion länger und inniger ausgesetzt, ihr erfolgreich widerstand.

Eine andere Seite der Frage illustrierten die wiederholt vorkommenden Fälle, in denen Kinder frühzeitig das elterliche Haus verlassen und späterhin doch von der Krankheit eines oder beider Eltern, der Phthisis, ereilt werden. Hier wird der Unbefangene sagen: Solche Leute sind ab ovo zur Phthisis verdammt und entgehen ihr nicht, wenn sie auch noch so sorglich den Phthisikern und den als schwächend bekannten Einflüssen aus dem Wege gehen. Der orthodoxe Bakteriologe sagt: Sie sind frühzeitig infiziert, die Tuberkulose ist latent und später manifest geworden. Zugegeben: aber was hat sie latent gemacht? Der Körper mit seinen individuellen, in der Hauptsache wohl ererbten Eigentümlichkeiten.

Dass die T.-Bazillen schon in frühester Jugend sich irgendwo im Körper ansiedeln und durch ihre Toxine eine mangelhafte Körperentwickelung-Habitus phthisicus, scapula scaphoides, Enge der oberen Thoraxapertur bedingen, dazu hat sich, wie v. Hansemann richtig bemerkt, keinerlei Stütze, weder in den klinischen Beobachtungen, noch in der anatomischen Betrachtung, heranbringen lassen. Hier hängt alles von der angeborenen Wehrkraft des Körpers ab, sie allein bestimmt das Gedeihen oder Eingehen des Tuberkelbazillus.

Eine praktische Ueberzeugung für den eigenen Gebrauch, getrennt von der wissenschaftlichen Ueberzeugung in diesem Sinne, hat übrigens jeder Arzt, der sich vor Schwindsüchtigen fürchtet und der nicht über den vorgekommenen Fall lacht, dass ein Arzt, nachdem er einen Schwindsüchtigen chloroformiert hatte, sich das Gesicht mit Aether abwusch.

Man thut Recht daran, vor der Ehe mit Schwindsüchtigen zu warnen, aber nicht etwa wegen der Gefahr für den gesunden Teil, sondern weil die Nachkommenschaft meist defekt ausfallen wird.

Bis jetzt wütet noch der Streit, ob die Phthise durch die Lungen oder durch den Darmtraktus erzeugt wird. In dieser Hinsicht dürfen wir nicht vergessen: einerseits, dass nicht alle, die mit Schwindsüchtigen zu thun haben, nicht nur nicht an lokaler Tuberkulose erkranken, geschweige denn an Phthise, andererseits sehen wir, dass tuberkulöse Milch nicht bei allen Darmtuberkulose erzeugt. Interessant in letzter Beziehung ist der letzte Bericht der preussischen Regierung, in dem ein Beispiel angeführt wird, wo zwei Kinder wochenlang rohe Milch von einer an schwerer Eutertuberkulose leidenden Kuh getrunken haben, ohne eine Gesundheitsschädigung zu erleiden. Vor wenigen Jahren sah ich im Sanatorium Belitz, Prof. Moeller monatelang Kälber mit bazillenhaltigem Auswurf futtern, wobei sie an Gewicht zunahmen und nicht an Darmtuberkulose erkrankten. Bekannt ist ja der Fall, wo ein Geisterkranker einen vollen Spucknapf bazillenhaltigen Auswurfs austrank und gesund blieb.

Alles das mahnt uns mit Vorsicht die Pathogenese der Krankheiten nur vom bakteriologischen Standpunkte aufzufassen. Es gibt noch viele dunkle Punkte in der Pathogenese der Tuberkulose.

Wie steht es nun mit der Vererbung der lymphatischen Anlage nach der neuesten biologischen Forschung?

Erscheint uns der ausgebildete Organismus als ein Bündel von Merkmalen oder elementaren Eigenschaften, so müssen wir für jede derselben besondere repräsentative Teilchen in der Keimesubstanz fordern. In dieser Beziehung gibt uns die Vererbungslehre in der Tierwelt Aufklärung, indem sie uns zeigt erstens die wichtige Tatsache, dass der Samen und die Eizelle, obgleich sehr verschieden ausgerüstet—die Eizelle durch Anhäufung plastischen Materials erheblich umfangreich, die Samenzelle klein, kompendiös—doch zwei gleichartige Bestandteile, die Geschlechtskeime enthalten, in deren Vereinigung das für die Vererbung wichtigste Moment zu erblicken ist. Zweitens, dass bei der Befruchtung die gleiche Zahl von Kernschleifen oder Chromosomen, väterlicher und mütterlicher Provenienz zusammentreten, um den ersten Furchungskern zu bilden und dass bei der nachfolgenden Ontogenese dieselbe Zahl auf die Nachkommen weiter übertragen wird.

Dass nun die Chromosomen Träger der Vererbung sind, wird durch eine Reihe von Tatsachen geradezu bewiesen, so dass wir nicht nur von einer Hypothese, sondern von einer Theorie der Vererbung hier sprechen können.

In experimenteller Weise sind diese Schlüsse gerechtfertigt durch die sogenannten Mendelschen Spaltungsgesetze, die das Auftreten oder Fehlen elterlicher Merkmale bei den Nachkommen in vielen Fällen befriedigend zu erklären imstande sind. Es handelt sich hier um den Wettstreit alternierenden Merkmalspaare bei der Vererbung. In diesem Merkmalspaare ist das eine Merkmal dominierend, d. h. es hat die grössere Vererbungskraft, das andere ist schwächer, hat also eine geringere Vererbungstendenz, ist rezessiv, wie der fachmännische Ausdruck lautet.

Gewiss ist in den vorliegenden Auseinandersetzungen noch viel Hypothetisches, aber haben wir in den Auseinandersetzungen der Infektionisten vielleicht weniger Hypothetisches?

Die Bakterienpräzipitine, sagt Martinus, reihen sich gleichwertig in die bekanntlich schon recht stattliche Zahl der bakteriellen Antikörper ein. Sie sind zwar nicht gerade verständlicher, aber auch keineswegs geheimnisvoller, wie die Antitoxine, die Bakteriolysine, die Hämolysine, die Zytotoxine, die Agglutinine, die Opsonine, mit denen die Bakteriologie als mit bekannten Grössen rechnet, wenn sie auch noch niemand gesehen oder gar chemisch identifiziert hat. Für die richtige Bewertung des Vererbungsproblems in der menschlichen Pathologie ist es aber gar nicht nötig, dass wir zu den letzten und tiefsten Problemen des allgemeinen biologischen Vererbungsproblems endgiltig Stellung nehmen, weil ja die ontogenetische Entstehung des hochorganisierten Menschen ihren eigenen Gesetzen folgt, die rein empirisch festzustellen Aufgabe der Erblichkeitsforschung in der Pathologie ist.

Der Vergleich der Uebertragung der Tuberkulose mit der Uebertragung der gewöhnlichen Infektionskrankheiten muss somit einen gewissen Fehler enthalten. Jedenfalls ist die übertriebene Ansteckungsfurcht bei Tuberkulose, die Phthisiophobie unbegründet. Wie sie heute sich äussert, bringt sie nur Schaden und Verwirrung, sicher keinen Fortschritt.

Die Beseitigung des Auswurfes soll geschehen, und zwar in der Weise, wie es die Leute im späteren Leben durchführen können. Bei alledem soll man aber doch nicht denken, dass man alle Bazillen wegfangen und so die Tuberkulose ausrotten könne. Mit solchen Absichten ist aller Bazillenfang und alles Desinfizieren Sisyphusarbeit. Nur vom Gesichtspunkte der Reinlichkeit, dieser Lieblingsschwester der göttlichen Hygiene und ich möchte fast sagen, der Aesthetik, hat eine energische Sputumbeseitigung Sinn.

Es sieht nach ihnen noch immer so aus, als ob die Einführung der Spucknäpfe und der Sputumdesinfektion in Verbindung mit Liegehallen das wesentliche ist, um die lymphatische Anlage niederzudrücken.

Wenn wir den Lymphatismus als Degenerationserscheinung ansehen, so fragt es sich: sind wir machtlos gegen seine Verbreitung oder besitzen wir Mittel, dem Uebel mit Erfolg entgegenzuarbeiten. Zur Bekämpfung des Lymphatismus stehen zwei Wege offen. Der erste besteht darin, beanlagten Individuen anzuraten nur mit gesunden sich zu verehelichen, was aber schwer zu erfüllen sein wird. Der zweite Weg ist das altbewährte Mittel, die Stärkung der Menschheit von der Wiege an durch hygienisch-diätische Mittel, an die sich medikamentöse Behandlung anschliesst.

Wir sehen ja jetzt in grossem Massstabe den Erfolg dieses alten Mittels bei der Bekämpfung der Tuberkulose. In ihrer ursprünglichen Form kümmerte sich die Brehmersche Therapie der Phthise überhaupt nicht um die Infektion, sondern erreichte ihr Ziel, die Heilung, durch Erhöhung der Widerstandsfähigkeit des menschlichen Organismus. Wir fügen nun den ursprünglichen Mitteln: Luftgenuss, Abhärtung durch hydropathische Massnahmen, Ernährung, mit grossem Erfolge noch den Lichtgenuss hinzu. Bringt uns die Bekämpfung der Exposition zu erhöhten Reinlichkeit, der Grundlage jeder Gesundungsmassnahme, so kommen wir auf Grund der Erfahrung zu einem tiefen Verständnis der hygienischen Faktoren der Umwelt.

Die hydrotherapeutischen Massnahmen in der Behandlung der lymphatischen Konstitution spielen noch immer nicht die hervorragende Rolle, die ihnen zukommt. Schon Plinius spricht von dem grossen Wert derselben im Allgemeinen. Eine Zeit lang gab es in Rom 9 Aquaedukte und es gab damals keinen Menschen, der nicht täglich ein Bad nahm. Und das Resultat? Die Aerzte hatten keine Praxis! Wir wissen, wie in England fast jeder Mensch täglich ein Bad nimmt und diesem Umstande ist es mit zuzuschreiben, dass die Schwindsucht in den letzten Jahrzeiten über 50 Prozent abgenommen hat (Winternitz).

Zum Zustandekommen eines Krankheitsfalles müssen, nach der konditionalen Denkungsweise (von Hansemann) mehrere Bedingungen zusammentreten. Wo die eine Bedingung z. B. die Vernichtung der Bakterein nicht möglich ist, kann eine der anderen Bedingungen bekämpft werden, zumal da sie praktisch fast in allen Fällen auch zu einer Bekämpfung der einen nötigen Bedingung, nämlich der Anwesenheit der Bakterien sich gestaltet. Als Beweis für eine solche Möglichkeit führt v. Hamsemann folgende Beispiele aus der Botanik an. Gegen Blattläuse sind bekanntlich alle möglichen Mittel empfohlen, aber resultatlos. Dagegen genügt es bei den Rosen einfach die Pflanzen zu düngen, um in wenigen Tagen ein Verschwinden der Blattläuse herbeizuführen. Bei Schneeball hilft dieses Mittel nicht, dafür wirkt aber ein Entfernen desselben aus ungenügend belichteten und gelüfteten Wohnungen. Sehr interessant ist folgendes Beispiel: in einem Kieferwalde, in dem einzelne Laubbäume stehen, kann man finden, dass unter diesen Laubbäumen sich eine ganz bestimmte Flora findet. Dasselbe hängt wesentlich ab von der Düngung des Bodens, einmal durch das abgefallene Laub und zweitens durch die Vögel, die ganz besonders auf diesen Bäumen nisten. Die Samen dieser Pflanzen, die überall im Walde auf die Erde geraten, finden eben nur an bestimmten Stellen einen günstigen Boden zur Entwickelung. Daraus ergiebt sich für die Tuberkulose, dass zwar die Anwesenheit der Bakterien eine notwendige Bedingung ist, aber nicht die einzige, es muss auch der geeignete Boden vorhanden sein.

Nicht Spucknäpfe sind also das wesentliche bei der Bekämpfung der Schwindsucht, sondern Abhärtung und Stählung der lymphatischen Konstitution durch hygienische Mittel. An sich ist es durchaus begreiflich, dass sich die Umgebung durch die Anhäufung von Tuberkulösen und speziell von Phthisikern für bedroht hält, seitdem ihr wieder und wieder gesagt wird, dass die Tuberkulose ansteckend ist. Die Bevölkerung ist verängstigt und es gilt jetzt wieder, einen richtigen Modus zu finden, um auch der Humanität zu ihrem Rechte zu verhelfen. Die Tuberkulosefurcht muss auf ein vernünftiges Mass zurückgeführt werden.

Beobachtung und Versuche müssen uns leiten und da erkennen wir zunächst, dass selbst der spuckende Phthisiker nicht zu allen Zeiten gleich gefährlich ist, dass die Masse seines Auswurfes und dessen Bazillengehalt sehr schwankt und dass über die Hälfte der Keime bereits abgestorben sind. Der Tierversuch lässt die Gefahr oft grösser erscheinen, als sie für den Menschen ist, weil für das Hauptversuchstier, das Meerschweinchen, die Tuberkulose eine absolut tötliche Krankheit ist.

Durch die hygienisch-diätetisch-hydriatische Methode wird auf verschiedene Bedingungen, die zur Entstehung der Schwindsucht führen, stets ein günstiger Einfluss ausgeübt. Durch diese altbewährte Methode wird die Osmose in allen Geweben geregelt und wo die Osmose geregelt ist, da hat der Bazillus meist keinen Boden zu seiner Entwickelung (Holzinger).

Fragen wir uns noch zum Schluss, wie im allgemeinen eine spezifische Behandlung, die Behandlung mit Tuberkulinen, das Bild der Tuberkulose beeinflussen kann, so muss man nach den Erfahrungen zu dem Schlusse kommen, dass Progredienz des Prozesses ohne natürliche Heilungstendenz eine Kontraindikation gegen die spezifische Behandlung bilden muss. Ist Heilungstendenz vorhanden, dann kann sich gewiss der Verlauf unter dem Einfluss der spez. Therapie günstiger gestalten. Es gibt, wie bekannt, eben geeignete Fälle und solche, die für eine spez. Therapie als ungeeignet anzusehen sind. Den gangbarsten Weg bei der Einleitung einer spez. Therapie der Tuberkulose muss man in der individuellen Behandlung sehen. Freilich erfordert dieser Weg eine ebenso grosse Erfahrung wie Sorgfalt, Vorsicht und auch Geduld bei der klinischen Untersuchung des Kranken, um eben den geeigneten Fall schon im Beginne einer Therapie zu erkennen, den ungeeigneten auszuschalten, aber wir werden so vollauf gerecht dem bewährten Leitspruche: primum non nocere.

Von rein theoretischem Standpunkte wurden Tuberkuline als spez. Mittel gegen Tuberkulose angewandt. Die Erfolge waren nur scheinbare. Auf rein empirischer Basis werden jetzt homöopathische Dozen verabreicht. Worauf die Erfolge beruhen sollen, ist bis jetzt nicht klar gestellt. Bei der Miliartuberkulose, wo man am ehesten direkt gegen die Bazillen spezifisch vorgehen könnte, sind keine Resultate erzielt, ebenso bei Lupus.

Für die Diagnose der Tuberkulose schien die Tuberkulinprobe gesichert zu sein, namentlich bei Rindern. In jüngster Zeit ist man aber schon in Deutschland zu der offiziellen Anschauung gelangt, die Tuberkulinprobe bei Rindern zum Zweck der Diagnose abzuschaffen.

Die Bedeutung der lymphatischen Konstitution ist für den Verlauf der meisten Krankheiten, namentlich der Schwindsucht ein sehr deletärer, aber wie wir gesehen, haben wir Mittel dieselben in energischer Weise zu bekämpfen. Trotzdem, dass der Ausbruch der Schwindsucht der letzte Accord des Liedes ist, das an der Wiege gesungen, können wir den Schlussaccord in weite Ferne herausschieben, wenn wir die hygienisch-diätetischen Massnahmen schon in der Kinderstube einbürgern—Haus-Sanatorien müssen unsere Kinderstuben darstellen—zur Bekämpfung der lymphatischen Konstitution.

Wir stehen in der Medizin im Sternbilde der Bakteriologie und der jetzt hochmodernen Haemotherapie und die Frage über die Pathogenese der Krankheiten wird jetzt meist nur vom Standpunkte der Bakteriologen beurteilt. Natürlich ohne Bakteriologie kann die Medizin nicht progressieren, aber wir dürfen sie doch nicht einseitig auf unser Handeln wirken lassen, sondern nur in Verbindung mit andern Wissenszweigen. Wir müssen alle Krankheiten und Krankheitszustände, so auch die lymphatische Konstitution erforschen im Lichte biologischer Forderungen.

The proceedings of the Joint Session of Sections V and I and of the Joint Session of Sections V and VII are found in Volume I, Part II.

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SECTION VI.

STATE AND MUNICIPAL HYGIENE.

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REPORT OF THE SECRETARY.

Dr. F. F. **Wesbrook**, *President of Section VI,*

Fifteenth International Congress on Hygiene and Demography.

Sir: I have the honor to present a report of the proceedings of Section VI (State and Municipal Hygiene) of the Fifteenth International Congress on Hygiene and Demography, meeting in Washington September 23 to 28, 1912, together with an account of the meeting of the Subsection on Sex Hygiene in the form of a report of the secretary, Dr. D. R. Hooker, to Dr. Prince A. Morrow, chairman of the subsection.

The section meetings were held in the ballroom of the Pan American Union. The joint sessions with Section VII were held in Continental Memorial Hall.

The first meeting, for the purpose of organization only, was held immediately after the opening ceremonies on Monday, September 23. The following announcements were made of honorary presidents of Section VI:

Dr. **Theodore Thomson**, London, England; Sir **George McCrae**, Edinburgh, Scotland; Geh. Regierungsrat Dr. A. **Weber**, Berlin, Germany; Geh. Hofrat Dr. A. **Gaertner**, Jena, Germany; M. A. **Bjerre**, Copenhagen, Denmark; M. **Emile Kern**, Paris, France; Mr. **Rudolph Hering**, New York; Dr. **Frederick Montizambert**, Ottawa, Canada; Dr. **Karl Imhoff**, Essen, Germany; Dr. **Seiji Tsukamoto**, Tokio, Japan.

The first scientific session occurred on Monday afternoon, a joint session with Section VII, to consider the general topic of public health organization and administration. The following papers were read:

Central Sanitary Administration in the United Kingdom, by Dr. Theodore Thomson.

Public Health Administration from the Standpoint of the Administrative County, by Dr. George Reid.

Memorandum Indicating the Method of Sanitary Administration of a Large Center of Population in England, by Dr. E. W. Hope.

Die Fürsorge für das öffentliche Gesundheitswesen im Deutschen Reich, by Geheimer Regierungsrat Dr. August Weber.

Die Verwaltung des öffentlichen Gesundheitswesen in Preussen, by Reg- Med-rat Dr. Schneider.

Die Organisation und die Verwaltungsmassnahmen der lokalen Verwaltungsbezirke auf dem Gebiete der öffentlichen Gesundheitspflege, by Dr. Fritz Kirstein, Kreisarzt für Stettin-Ost, Germany.

The joint session of Sections VI and VII continued the consideration of the same general topic on Tuesday, September 24, when the following papers were read:

The Public Health Service in Denmark—its Organization and Administration—the more Important Laws and Regulations in Force, by Dr. Anders Johansen, Chief of the Office of the Board of Health of Denmark.

Outlines of the Progress of Hygiene in the Kingdom of Denmark, by Dr. J. Carlsen, Chief of the Bureau of Statistics of Denmark.

Legislative and Administrative Aspects of Public Health Engineering, by A. Bjerre, Secretary to the City Engineer, Copenhagen.

Institutions of Sanitary Administration in Japan, by Dr. Seiji Tsukamoto, Counselor in the Department of the Interior, Tokyo, Japan.

Federal Public Health Administration in the United States, by Dr. John W. Kerr, Assistant Surgeon General, United States Public Health Service.

In the discussion following this symposium, Dr. Federico Torralbas, of Habana, gave a brief account of the Department of Health of the Republic of Cuba.

TUESDAY, SEPTEMBER 24—2 P. M.

In the symposium on sanitary aspects of public water supplies the following papers were read:

Purification of Water by Storage, by Dr. A. C. Houston, Metropolitan Water Board, London.

The Purification of Water from a Hygienic Standpoint, by Allen Hazen, civil engineer, New York.

The Purification of Water from Standpoints other than the Hygienic Aspect, by George W. Fuller, civil engineer, New York.

Water Sterilization by Chemical Methods, by Dr. Samuel Rideal, London.

Stérilization des eaux par l'ozone, by M. Dienert, Chef du Service des Eaux d'Alimentation de Paris.

The following members of the congress joined in the discussion:

Mr. George A. Johnson (New York City): Prof. Dr. August Gaertner (Jena, Germany).

WEDNESDAY, SEPTEMBER 25—9.15 A. M.

The following papers were read in the symposium on disposal of sewage and wastes:

Sewage Disposal by Oxidation Methods, by John D. Watson, chief engineer, Drainage Board, Birmingham, England.

Sewage Disposal by Oxidation Methods, by Gilbert J. Fowler, consulting chemist to the Manchester Corporation Rivers Committee, Manchester, England.

Sewage Disposal by Oxidation Methods, by Robert S. Weston, civil engineer, Boston, Mass.

These papers were discussed by Mr. Rudolph Hering (New York).

Methods of Sludge Disposal, by Dr. Karl Imhoff, Essen, Germany.

This paper was discussed by Mr. Rudolph Hering (New York) and Dr. Karl Imhoff (Essen, Germany).

Disposal of City Refuse, by Rudolph Hering, consulting engineer, New York.

Rapport sur les Ordures Ménagères, by M. Emile Kern, civil engineer, Paris, France.

The following resolution was adopted by the section, and subsequently approved by the Permanent International Commission:

Resolved: I. That the disinfectants used in different countries should be controlled by a simple bacterial test, capable of being easily effected, and that a committee from this congress do confer with a committee of the International Congress of Applied Chemistry to define such a test.

II. That the Permanent International Commission of the Congresses on Hygiene and Demography be requested to appoint a committee of not less than five members to represent this congress for this purpose.

THURSDAY, SEPTEMBER 26—9.15 A. M.

At the fourth session the subject for consideration was public health education. The following papers were read:

The Training and Status of Public Health Officers in the United Kingdom, by Dr. G. H. F. Nuttall, Quick Professor of Biology at the University of Cambridge, England.

The Development of Educational Efforts in Public and Personal Hygiene in America, by Dr. Livingston Farrand, New York.

Instruction in Hygiene in Medical Colleges and the Training of Health Officers, by Dr. F. F. Wesbrook, dean of the College of Medicine of the University of Minnesota.

The Training of Sanitary Engineers, by George C. Whipple, professor of sanitary engineering in Harvard University.

The Training of Visiting Nurses, by Adelaide Nutting, Department of Nursing and Health, Teachers' College, Columbia University, New York.

The Field of the Department of Physical Training in Educational Institutions in the Development of Public Hygiene, by Prof. Dudley A. Sargent, director Hemenway Gymnasium, Harvard University.

General Elementary Training in Hygiene in Public and Private Schools, by Dr. John W. Ritchie, College of William and Mary, Williamsburg, Va.

The Value of Popular Lectures in the Education of the Public in Personal Hygiene, by Dr. Rosalie Slaughter Morton, New York.

Le Problème de l'Éclairage, de l'Aération et du Chauffage de la Chambre á coucher et sa Solution, by M. Augustin Rey, Paris, France.

THURSDAY, SEPTEMBER 26—2 P. M.

The fifth session of the section was held to consider certain social aspects of public hygiene. The following papers were read:

Sanitary Aspects of Housing Problems, by Robert W. de Forest, New York City.

Sur les Habitations à bon marché et la Tuberculose, by M. Georges Risler, Paris, France.

Rural Hygiene, by Prof. H. N. Ogden, Cornell University, Ithaca, N. Y.

Rural Hygiene, by Dr. J. N. Hurty, president of the American Public Health Association.

The Problem of Drunkenness, by Dr. Irwin H. Neff, Foxborough State Hospital for Inebriates, Foxborough, Mass.

The Prevention of Inebriety, by Mr. Robert A. Woods, Boston, Mass.

Garden Cities, by Georges Benoit-Levy, Paris, France.

Modern Town Planning, by Sir George McCrae, Vice President Local Government Board for Scotland, Edinburgh.

La Cité hygiénique de l'avenir, by M. Augustin Rey, Paris, France.

Present Status of Ventilation, by D. D. Kimball, civil engineer, New York.

The New Art of Ventilation, by Prof. C.-E. A. Winslow, curator of public health, American Museum of Natural History, New York.

FRIDAY, SEPTEMBER 27—9.15 P. M.

The sixth session was devoted to a symposium on certain sanitary aspects of food production and control. The following papers were read:

The Evolution of the Handling of Perishable Products, especially at the Source of Production, by M. E. Pennington, Food Research Laboratory, United States Department of Agriculture.

A Sanitary Regulation of Industrial Establishments Manufacturing or Handling Food Materials, by H. E. Barnard, State Food and Drug Commissioner, Indianapolis, Ind.

The Sanitary and Hygienic Aspects of the Cold Storage of Foods, by Dr. Herbert D. Pease, Lederle Laboratories, New York.

Municipal Supervision of Food Supplies and their Distribution, by Dr. Mosby G. Perrow, Lynchburg, Va.

FRIDAY, SEPTEMBER 27—2 P. M.

The seventh session of the section was given over to consideration of the sanitary betterment of milk production and distribution. The following papers were read:

The Function of Central Official Agencies looking toward the Improvement of Milk Production and Distribution, by B. H. Rawl, Chief of the Dairy Division of the Bureau of Animal Industry, Washington.

The Function of the State in Milk-Control Work, by H. L. Russell, dean, College of Agriculture, Madison, Wis.

The Sanitary Control of Local Milk Supplies through Local Official Agencies, by Dr. Ernst J. Lederle, commissioner of health, City of New York.

The Work of Medical Milk Commissions in the Campaign for the Betterment of Milk Production and Distribution, by Dr. Henry L. Coit, Newark, N. J.

The Function of Voluntary Organizations in the Campaign for the Betterment of Milk Production and Distribution, by Nathan Straus, New York.

The Case for Pasteurization, by Prof. Edwin O. Jordan, University of Chicago, Chicago, Ill.

The Sanitary Betterment of Milk Production and Distribution, by Dr. G. Lloyd Magruder, Washington.

These papers were discussed by Mr. Oscar B. Schier (Baltimore, Md.) and Mrs. William Lowell Putnam (Boston, Mass.).

Reports of discussions as given to the secretary will be found in the transactions of this section.

Respectfully submitted.

HERBERT D. PEASE, M. D.,
Secretary of Section VI.

TUESDAY AFTERNOON, SEPTEMBER 24, 1912.

PURIFICATION OF WATER BY STORAGE.

Dr. A. C. Houston, Director of Water Examination, Metropolitan Water Board, London.

In presenting this brief paper on the beneficial effects of storage it must not be supposed that I belittle or regard with disfavor other methods of purifying water. The contrary, indeed, is the case, as is clearly indicated in the records of my prolonged experiments.

In 1905 and subsequent years I sterilized[1] the water supply of Lincoln (population over 50,000) by means of chloros (alkaline solution of sodium hypochlorite). Since 1905 I have had a varied and, on the whole, highly successful experience with the hypochlorites as sterilizing agents, and in the present year (1912) I described[2] a new way of using lime, primarily for bactericidal and secondarily for softening purposes.

The fact, however, remains that not a few persons are hostile to the use of chemicals in connection with water supply, and to these persons the purification of water by means of storage will surely appeal as being nature's own method of sterilization.

The processes which make for the purification of water under storage conditions are chiefly these: (1) Sedimentation, (2) equalization, (3) devitalization.

(1) *Sedimentation.*—In the old days this was regarded as the chief, if not the only, factor of consequence. Though we now know that sedimentation is insufficient *per se* to produce the desired results, yet its importance is clearly indicated in Section V of my Seventh Research Report to the Metropolitan Water Board.[3]

(2) *Equalization.*—This factor has never received the attention it deserves. If the water destined to be stored was of uniform composition, and without intermission contained the microbes of water-borne disease, no equalization, in the sense I refer to, could take place. As judged, however, by the usual chemical and bacteriological tests, the quality of a river water varies enormously from time to time, and it goes without saying that mere storage on purely physical grounds undoubtedly discounts abrupt fluctuations in its quality.

My observation and experience, moreover, confirm me in my belief that even sewage-polluted river waters do not uniformly, or of necessity, contain (i. e., in ascertainable numbers) the microbes generally associated with water-borne disease (e. g., the typhoid bacillus). In support of the truth of this statement, reference may be made to my various reports[4] to the London water board, in which I adduce detailed evidence that when equal volumes (A and B) of raw Thames River water, which is admittedly sewage polluted, are taken, and the one part (A) is purposely infected artificially with the typhoid bacillus and Gärtner's bacillus, and the other part (B) is not so infected, it is comparatively easy to isolate the aforesaid artificially added microbes from (A), whereas it is practically impossible to demonstrate their presence in (B).

In the case of the River Thames raw water, while it is possible that the typhoid bacillus may be uniformly present, yet surely it must be in such very few numbers as to be practically non-discoverable.

On the other hand, it may be that although only occasionally present, its numbers, when thus occurring, are of serious import.

If the latter view is the correct one, my point is that, apart from sedimentation and devitalization, the "leveling" effect of adequate storage would probably so average the infected and non-infected waters as to render the final mixture reasonably if not demonstrably safe. To take a concrete example: Imagine an individual who has the misfortune to be a typhoid carrier obeying the calls of nature in such a way as to contaminate a river water a short distance above two adjacent intakes supplying two towns, A and B. In the case of A, the water, let us say, is taken directly on to the only line of defense, namely, the filter beds, by means of which we can hope to remove only 98 per cent of the bacteria of all sorts.

On the other hand, let us assume that in the case of B its main line of defense is adequate storage antecedent to filtration; it must be obvious that, even apart from sedimentation and devitalization, the probabilities of an epidemic resulting would be enormously greater in the case of A as compared with B.

(3) *Devitalization.*—This is a factor of supreme, if not paramount, importance. Beyond all question the ultimate fate of the microbes of epidemic disease (e. g., typhoid fever and cholera) in water is merely a question of time.[5] The precise period of time necessary for the deterioration and final destruction of pathogenic bacteria is open to controversy. It is known to vary with the temperature, and, no doubt, is also influenced by many other factors. According to my experiments, even one week's storage would produce a larger percentage reduction in the initial numbers of typhoid bacilli and cholera vibrios than we could ever hope to achieve by the use of sand filters alone under the usual practical conditions of working.

For the absolute elimination of these pathogenic bacteria, without question several weeks' storage may be required, but, for all practical purposes, I am of the opinion that provision for 30 days' real storage is ample; that is, when dealing with *sources of supply comparable to those of London.*

A great testimonial has been given as to the beneficial effect of storage by the experimental proof that "uncultivated" bacilli succumb in raw river water at a more rapid rate than their "cultivated" brethren.[6]

With the object of demonstrating, at least to my own satisfaction, that my faith was equal to my experimental knowledge, it is now generally known that I drank half a pint of Thames River water initially of set purpose contaminated with typhoid urine containing myriads of typhoid bacilli, these personal experiments having been made on the twenty-fourth, twenty-fifth, twenty-sixth, twenty-seventh, and twenty-eighth day after the date of the original infection of the water, in the first test, and on the twenty-third, twenty-fourth, twenty-fifth, twenty-sixth, and twenty-seventh day in the second test. In these experiments the initial number of typhoid bacilli per half pint was computed at 218,680,000 in the first experiment and 468,000 in the second experiment.

In the first case 770,000 typhoid bacilli per cubic centimeter of the infected water became reduced to only 4 within one week, and subsequent cultures, made with 1, 10, and 100 cubic centimeters of the infected water on the fourteenth, eighteenth, twenty-first, twenty-seventh, and twenty-ninth day after the start of the experiment, all yielded negative results as regards isolation of the typhoid bacillus.

In the second case the initial number of typhoid bacilli was computed at 1,650 per cubic centimeter of the infected water, and at the end of a week none could be revealed in 1 cubic centimeter. Subsequent cultures made with 1, 10, and even 100 cubic centimeters of the infected water on the tenth, fourteenth, nineteenth, twenty-first, and twenty-eighth day after the start of the experiment likewise yielded negative results as regards isolation of the typhoid bacillus.

Markedly different results were obtained after the previous isolation and laboratory cultivation of the typhoid bacilli derived primarily from the urine of the foregoing "carrier" case. In its "cultivated" state the bacillus was indeed found to survive for five weeks in river water under otherwise comparable conditions of experiment.

Inasmuch as the danger as regards typhoid of drinking polluted water is mainly due to the possible presence of "uncultivated" typhoid bacilli, these observations are of far-reaching importance.

It is impossible within the compass of this paper to do more than condense the chief points showing the advantages (*in the case of London*) accruing from the simple storage of raw river water:

(1) Storage reduces (*a*) the number of bacteria of all sorts; (*b*) the number of bacteria capable of growing on agar at blood heat; (*c*) the

number of bacteria, chiefly excremental bacteria, capable of growing in a bile-salt medium at blood heat; (*d*) the number of coli-like microbes; (*e*) the number of "typical" *B. coli;* (*f*) the amount of suspended matter, color, ammoniacal nitrogen, and oxygen absorbed from permanganate; and (*g*) the hardness.

(2) Storage alters certain initial ratios, for example: (*h*) It reduces the number of typical *B. coli* to a proportionately greater extent than it does the number of bacteria of all sorts; (*i*) the color results improve relatively to a greater extent than those yielded by the permanganate test.

(3) Storage, if sufficiently prolonged, devitalizes the microbes of water-borne disease, e. g., the typhoid bacillus and the cholera vibrio.

(4) Storage produces a marked "leveling" or "equalizing" effect.

(5) An adequately stored water is to be regarded as a "safe" water, and the "safety change" which has occurred in a stored water can be recognized and demonstrated by appropriate tests.

(6) The use of stored water permits of a constant check being maintained on the safety of a water antecendent to and irrespective of filtration.

(7) The use of stored water goes far to wipe out the gravity of any charge that a water supply is derived from polluted sources.

(8) The use of adequately stored water renders any accidental breakdown in the filtering arrangements much less serious than might otherwise be the case.

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[1] In conjunction with Dr. MacGowan, who had charge of the chemical side of the investigation.

[2] Eighth Research Report, Metropolitan Water Board.

[3] The natural process may be greatly assisted and hastened by the artificial use of coagulants, e. g., aluminoferric. (See Sec. VI of my Seventh Research Report.)

[4] Fifth and Seventh (sec. 1) Research Reports.

[5] See first, third, fourth, sec. 5 of fifth, sixth, and secs. 2 and 3 of seventh Research Reports, Metropolitan Water Board.

[6] Sixth Research Report, Metropolitan Water Board; also Sec. II of Seventh Research Report.

THE PURIFICATION OF WATER FROM A HYGIENIC STANDPOINT.

ALLEN HAZEN, C. E., New York City.

The progress in water purification from a hygienic standpoint has been very rapid in the last decade. This progress has been of two kinds:

First, there has been a great increase in the number of water supplies that are being purified with satisfactory hygienic results.

Second, there has been an advance in the standards of efficiency and in the methods available for reaching them in practical work.

The growth in the purification of water is shown by the following table:

Population supplied with filtered water at different dates.

Year.	Total urban population in United States in places of more than 2,500 inhabitants.	Population supplied with filtered water.			Per cent of urban population supplied.
		Sand filters.	Mechanical filters.	Total.	
1870	....	None.	None.	None.	0
1880	13,300,000	30,000	....	30,000	0.23
1890	21,400,000	35,000	275,000	310,000	1.45
1900	29,500,000	360,000	1,500,000	1,860,000	6.30
1910	38,350,000	3,883,000	6,922,000	10,806,000	28.20

From this it appears that the population supplied with purified water increased more than fivefold in each of three successive decades. In 1910, 28 per cent of the whole urban population of the United States was so supplied.

Twenty years ago a considerable proportion of the largest cities of the United States were supplied with water polluted by sewage and notoriously injurious to health. At the present time this practice has mainly ceased. There are still a few of the larger cities that supply water that, in some respects, is not of as good quality as could be desired. But all of the larger cities that supplied notoriously bad water at the date mentioned have improved their supplies in one way or another, and in many or most cases filtered water of excellent quality is supplied at the present time. The smaller cities have followed in the same way, but more slowly. While there are some exceptions, a majority of them now have water of at least fair quality.

The statistics above relate to filtered water. They cover only part of the whole field, for in the last years other means of treating polluted waters, which are important from a hygienic standpoint, have come into general use. No statistics have been compiled to show what additional population is supplied with water so treated, but, if it were taken into account, it may be conservatively stated that from one-half to two-thirds of the whole urban population of the United States is now supplied with water that has been purified to a greater or less extent.

The advance in the methods of purifying water from a hygienic standpoint has not been less important than the increase in population supplied with purified water. Some years ago methods of water purification were in common use for treating highly polluted waters which secured the removal of bacteria to the extent of 97 and 99 per cent, and occasionally, with well-built and well-operated plants, higher percentages, up to 99.5 and even 99.9, were obtained. These figures relate either to all the bacteria in the raw water or to some portion thereof as shown by the methods of examination commonly used. The presumption was that any injurious bacteria that there might be in the raw water would be and actually were removed in as great proportion as were the kinds that could be counted. This was always a matter of some uncertainty and there was reason for thinking, in some cases at least, that the removal of pathogenic bacteria may have been more complete than the removal of bacteria in general. However this may be, it is true that cities supplied with water drawn from highly polluted rivers purified by filtration to the extent above mentioned, were as free from diseases which could be attributed to the public water supply as cities supplied with upland water of the best quality.

It was obvious that filtration was a relative and not an absolute protection against the impurities of the raw water. Some bacteria undoubtedly passed through the filters, and if pathogenic bacteria were present in the raw water a few of them might pass the filters and reach those who used the water. If a river had a population of 100 per square mile on its catchment area, and if the filter plant removed 99 per cent of the bacteria, the water after filtration might be compared with water from a river otherwise similar, but with a population of 1 per square mile.

There was some indication that a falling off in bacterial efficiency had an appreciable effect upon the health of the community. There were notable cases where filters of inferior or inadequate construction, or operated with less than the usual degree of skill, produced, temporarily or permanently, effluents inferior from a bacterial standpoint to those otherwise produced by the best filter plants; and there were cases where diarrhea, typhoid fever, and other indications of water pollution among those who used the water had followed such falling off in efficiency.

Skillful manipulation of filters must be regarded as equally important with good design in securing at all times an output of well-purified water. The best designed plants may produce poor or bad effluents with careless or unskillful manipulation, and skillful manipulation will do much to improve the average quality of the effluent from old plants not representing modern standards of construction. As the years have gone by and the number of water-purification plants has increased, there has been found a rapidly increasing number of men who have had experience and have acquired skill in operation; and the fact that such men have been available and have been secured to operate purification works has been a most important element in the improvement in the average results that have been secured.

It is more difficult to keep filters up to a high standard of efficiency during the cold weather of winter and early spring than at other times, and failures of this kind were most frequent at this season of the year. It was perhaps a fair inference that if the use of raw water caused a very great amount of disease among those who used it, and if poorly filtered water during the winter caused a slight though perceptible increase in the same diseases that were caused by the raw water, that the smaller number of bacteria normally passing into the effluent might produce an effect upon the health of those using the water, even though this effect was too small to be measured by such vital statistics as could be obtained.

In the last years the practice of treating filter effluents, as well as raw waters, with hypochlorite of lime, has become very common. Applied in very small amounts to clear waters that do not contain too much organic matter, it produces an extraordinary bactericidal effect. This substance had been used for many years as a disinfectant, but usually in much larger quantities. It was something of a discovery to find how efficient it was, in extremely small doses, in killing bacteria in water free from turbidity and organic matter. This condition certainly could not have been anticipated from earlier practice with it or from the literature on the subject.

Hypochlorite of lime is by no means the first or only substance that has been proposed and used experimentally and applied in practice in a few small installations for many years. Ozone has been tried repeatedly, but the practical difficulties of carrying out the ozone process effectively, and the great expense of doing it, have operated as obstacles to its general introduction. Hypochlorite of lime seems to have precisely the same bacterial effect as ozone, and it can be applied more easily and is free from some of the uncertainties that have been found to be adherent to the ozone process. Ozone has some advantages, and if means can be found for overcoming present difficulties its use will be another step in advance.

Sulphate of copper and other metallic salts have also been proposed for killing bacteria as well as algæ in water. It is permissible to use such a substance, if it is applied to the raw water prior to filtration, so as to secure a disinfecting action, and then have the metallic residue removed in the process of filtration. Some of these processes proved to have merit, especially in connection with filtration, but their use was always limited by the unwillingness of most of those in charge of waterworks to use metallic substances which were more or less poisonous.

The use of hypochlorite of lime has practically superseded all such metallic substances, as it is more efficient and is quickly decomposed in the water into substances that are not poisonous, and, within reasonable limits, can not by any possibility be injurious.

Other methods of killing the bacteria in filter effluents have been proposed, among which may be mentioned the use of the ultra-violet rays; but no plants for treating water in this way upon a practical scale have been installed in America, and the process is therefore one for future consideration rather than of established position.

Hypochlorite of lime has considerable power from a hygienic standpoint, even when applied to the raw water and without filtration. In this case, a larger dose must be used, and it frequently must be a variable one, because enough must be applied to furnish oxygen for the rapid oxidation of organic and other matter in the water, and still leave a sufficient excess to perform its germicidal work. The amount required for the oxidizable matter obviously depends upon the composition of the water, and this frequently fluctuates rapidly from day to day and even from hour to hour. The treatment of raw water has been less efficient and is less satisfactory than the treatment of filtered water, and has not infrequently resulted in occasional overdoses which have been objectionable to users of the water.

From a hygienic standpoint the use of hypochlorite of lime is probably the most important event, after the extension of filtration works, in the last decade, and, where filtration is employed, it permits the delivery of water in which the bacteria have been removed uniformly and certainly to the extent of 99.9 per cent or more, or, in other words, of water containing only a fraction, and sometimes a small fraction, of the bacteria which would have been present in the effluent under the most favorable conditions of operation without its use.

The use of this process has made it possible to deliver from filter plants of good construction water that is of uniformly excellent hygienic quality. There is no reason to believe that any appreciable danger will result from the use of such water, even when drawn from the most highly polluted sources that are now in use for public water supplies.

With the great extension of filter plants, and the development and use of these supplementary processes, the time is rapidly approaching and has, in fact, been reached for a large part of the urban population of the country, when public water supplies will cease to be agents for the transmission of disease. On the other hand, many experiences in widely separated cities should teach that constant care is the price of safety, and that every reasonable effort must be made to prevent the occurrence of any condition that would interrupt, even temporarily, the efficiency of the processes that are relied on for safety.

The processes that have been successfully applied for the removal of bacteria from water may be applied, with modifications adapting them to the change in conditions, to removing bacteria from sewage. There has been a renewed effort, under the stimulus of these new methods, to secure the disinfection of all sewage discharged into rivers and lakes from which public water supplies are taken. This impulse represents a most commendable interest in public water supplies, and a desire to protect them from pollution.

It must be recognized, however, that it is more difficult and expensive to remove bacteria from sewage than from drinking water; and the process, even under the most carefully controlled conditions, is at the present time far less certain in its operation when applied to sewage.

The question of the combined or separate system in sewers, the treatment of storm overflows, and the treatment of street washings discharged by drains which do not carry sewage, all have to be considered in connection with this general question.

Up to the present time improvement in public water supplies has come almost entirely through methods of improving the water used. Improvement of water supplies by purifying the sewage that flows into the water from which they are taken has played hardly an appreciable part in the improvement of water supplies in America.

Looking at the matter broadly, these conditions must be expected to continue for the present, and further improvement in water supplies is to be expected from improvements in methods of purifying the water, and from increased care and faithfulness in carrying them out, rather than from the more extended use of sewage purification.

THE PURIFICATION OF WATER FROM STANDPOINTS OTHER THAN THE HYGIENIC ASPECT.

George W. Fuller.

In addition to hygienic purity a perfectly satisfactory water supply should be of good appearance as to absence of mud, vegetable stain, grosser microscopic organisms, soluble and suspended iron; and it should also be free of offensive tastes and odors, excessive hardness, and abnormal corrosive action on service pipes.

Within certain reasonable limits, depending upon local conditions, all of these characteristics are worth obtaining in a first-class modern water supply. In fact, the standards of "physical and chemical quality," as distinguished from "hygienic or bacterial quality," are steadily growing higher, due to the demands of the consumers for a supply in which there is public confidence and which does away with bottled water and household devices for treating the public supply. Indirectly, this question is related to the public health through the tendency of the public to avoid for drinking purposes a hygienically pure but otherwise unattractive public water supply, and to use well water or bottled water of doubtful bacterial content.

In this paper it is intended to outline briefly some of the recent developments in America concerning the physical and chemical features of water purification and to refer incidentally to the historical development of some of the more important steps.

REMOVAL OF MUD OR TURBIDITY.

Plain sedimentation.—Fifteen years ago, or prior to the completion of the Louisville tests in 1897, the clarification of the muddy water which is so characteristic of the majority of American rivers was but partly accomplished, if at all. Plain sedimentation when applied at its best ordinarily removed only 50 to 75 per cent. of the total suspended matter. With basins holding several days' supply, such as those at Washington, Philadelphia, Pittsburgh, Louisville, St. Louis, Kansas City, and Omaha, the effluent as delivered to the consumers contained for weeks at a time sufficient silt and clay to make it conspicuously muddy. At times the partly settled water contained several hundred parts per million of suspended matter.

Storage reservoirs and avoidance of muddy water.—In some instances the basins were large enough to serve as storage reservoirs from which the supply from the river was shut off at periods of very muddy water in the stream. This procedure was used to advantage for some years at Washington, Baltimore, Covington, York, and elsewhere. It is expensive and is seldom tried at present. When the river is muddy for a period exceeding the storage capacity of the basin the benefit of the method not only fails, but for many weeks the consumers may have to use muddy water diluted to a varying extent with clear water.

Coagulation and sedimentation.—Many years ago it was the custom in the Southern States to clarify the water used at some households by putting a piece of alum in a forked stick and stirring it about in a barrel of water. Sedimentation then allowed a fairly clear water to be obtained. This practice is more or less similar to that which was followed many centuries ago in Egypt and in the Orient. Sulphate of alumina is capable of complete decomposition by the carbonates and bicarbonates of lime and magnesium naturally present in all ordinary waters, so that there is formed a gelatinous white precipitate of aluminum hydrate. This sticky mass envelopes the tiny particles of clay and also the bacteria, and forms them into particles that subside quite readily.

This process, which is in effect a chemical precipitation method, is of considerable assistance, in that it provides a fairly efficient means of removing those minute clay particles, perhaps one-tenth of the size of the bacteria, which will not settle by plain subsidence in an indefinite period. When coagulating chemicals, such as sulphate of alumina or sulphate of iron in connection with lime, are added to the water, it is possible to obtain a fairly clear effluent, provided a proper dose of coagulant is used with respect to quantity and quality of turbidity, and further provided that a period of one to two days or more is allowed for the particles of suspended matter to deposit upon the bottom of the basin. This method has been used at quite a number of places, and is still in use at St. Louis, Kansas City, Leavenworth, Omaha, Nashville, and elsewhere. It is not wholly satisfactory, when compared with the results obtained by filtration, as there is no ready way to correct the poor results obtained from an inadequate dose of coagulant. This correction is much more feasible when use is made of a filter plant. For ordinary problems, the method can scarcely be called a complete and satisfactory solution of clarifying muddy water, although its favor has been enhanced somewhat recently in conjunction with sterilization processes, such as the application of hypochlorite of lime.

Plain sand filtration.—Forty-five years ago sand filtration was substantially an unknown art in America. There were some crude strainers of artificial construction, but they are unworthy of detailed consideration. The art of sand filtration in America dates from about 1867, when the late James P. Kirkwood, C. E., made an extensive tour of the leading European cities and prepared a report for the Water Commission of St. Louis, Mo., detailing the results of his foreign studies. That report has become a classic, not only in America, but also in Europe, where it was translated into German. It exercised much influence in standardizing the European practice of water filtration.

After Mr. Kirkwood's return to America, by tests with small sand filters, he observed that they would not remove the enormous quantities of sand, silt, and clay, such as are found in the Mississippi River at St. Louis. On a somewhat larger scale the same conclusion was demonstrated by tests conducted with the Ohio River water, in 1884, by the late Charles Hermany, at Louisville.

With the advent of the germ theory of disease there was in America 30 years ago a feeling among engineers that sand filtration was impracticable, through inefficiency and great cost, for the ordinary American problem. Two or three small plants were built in the early seventies along the Hudson River, particularly at Poughkeepsie and at Hudson, but the question of water clarification remained substantially in abeyance until it was pushed forward as an incidental feature of hygienic water purification.

It was the work of the Massachusetts State Board of Health, through its tests conducted at the Lawrence Experiment Station and its advocacy of the Lawrence city filter plant in 1892, that marked the beginning of the present period of widespread installation of modern filter plants in America. The Merrimac River at Lawrence contains almost no clay, and but little silt other than at rare intervals when the river is in extreme flood. The data from Lawrence, therefore, while applicable for many of the problems in New England, did not offer a solution of the typical American problem of water clarification or of water purification.

Sand filters, when operated at fairly slow rates—say, from two to six million gallons per acre per day—are efficient in removing fairly coarse silt in quite large amounts. Fine clay particles, however, generally pass through the ordinary sand filter, even when operated at rates much lower than what is called standard European practice, namely, 100 millimeters vertical drop per hour, or 2,650,000 gallons per acre per day. Experience shows that when the unfiltered water contains for several days at a time more than about 30 to 50 parts per million of fine turbidity the effluent is liable to suffer from deterioration in quality, not only as to its appearance, but also bacterially.

There are some exceptions to the rule, but, generally speaking, sand filters outside of the New England States and of some points along the Atlantic seaboard have not been successful in treating American river waters even after they have been submitted to prolonged sedimentation. The only sand-filter plant along the Mississippi River, for instance, at Rock Island, Ill., was abandoned some years ago and in its place was built a mechanical filter plant.

Sand filters aided by sedimentation and coagulation.—In 1898 the writer conducted extensive experiments for the city of Cincinnati, Ohio, upon the clarification and purification of the muddy Ohio River water by sand filtration in conjunction with sedimentation and coagulation. Similar tests were made in 1901 at New Orleans. This method can be made efficient, but it is ordinarily more expensive than when mechanical filters are used in place of sand filters. Local conditions influence the solution of this problem. Successful use of sand filters with coagulation is to be found at Indianapolis, Washington, Poughkeepsie, and some other places. The feature which needs especial care is to see that the flocs of coagulated masses are removed from the water with sufficient care so that the surface of the sand bed does not become clogged too quickly. Ordinarily the water should undergo sedimentation for 18 to 24 hours before it reaches the sand beds. This feature adds to the cost of the complete method, and in cases where insufficient coagulant is used there is some danger from serious clogging of the sand beds.

Sand filters and prefilters.—At present there are few or no instances where decided exception is taken to the use of coagulants. Experience has shown that it is safe and feasible to use them wherever there is intelligent management. Local custom and existing works, however, in some instances force a consideration of methods in which no use is made of these very helpful coagulants. This has led to efforts to clarify water by preliminary filters as well as by sedimentation before application to ordinary sand beds. This is the method in use at Philadelphia, Steelton, Wilmington, Albany, Montreal, and some other places. If the river water is not too muddy from fine turbidity, it is of considerable aid. The method has decided limitations, however, in that at times of severe flood the percentage removal of suspended matter is least when it should be most in order to properly prepare the water for normal sand filtration.

In several instances coagulation is used in conjunction with some straining device, such as the practice at Steelton, and arrangements of this general order are now being installed at Pittsburgh to aid the local sand filters.

Mechanical filters.—Where coagulants are required mechanical filters have rapidly come to the front during recent years. They have been installed or have been recommended for use at nearly every plant of considerable size, outside of the New England States, during the past few years. The modern mechanical filter plant is so well known from numerous published articles that no description is necessary here. It is quite different from and materially better than the earlier devices of this general type. The plant of the East Jersey Water Co., at Little Falls, N. J., was placed in service in September, 1902. It was the first large plant in practice to embody the technical and engineering features developed from the tests at Louisville, Cincinnati, Pittsburgh, and other places.

This type of plant ordinarily operates at the rate of about 2 gallons per square foot per minute. When the water is properly coagulated, such filters may satisfactorily perform at rates from 25 to 50 per cent. in excess of this rate. Such devices deliver a water of excellent appearance and under proper supervision they are substantially as efficient as sand filters in securing bacterial removal. These plants have recently been built with concrete tanks and hydraulically-operated gate valves to control the operation of the plant, as well as with automatic appliances to insure a pro rata application at all times of solutions of chemicals to the varying volume of water to be filtered. Their recent history is closely identified with a succession of mechanical improvements which allow the devices to be operated reliably and economically. The cleaning of the sand layers is done once or twice a day by reversing the flow of water for periods of five minutes or so at a time. While the water is flowing upward through the sand layer, the sand is also stirred by compressed air, in cases where the water is not applied at sufficient velocity (2 feet vertical rise per minute) to bring about this result.

Mechanical filters have been installed at Little Falls, New Milford, Louisville, Harrisburg, Cincinnati, Columbus, Toledo, New Orleans, and at some 300 smaller plants. This type of filter constitutes the characteristic method now in vogue in America for insuring a well-clarified water supply from the ordinary American rivers which are highly charged with silt and clay. Undoubtedly it is the most efficient and economical arrangement for the majority of American water purification problems outside of certain areas along the Atlantic seaboard.

COLOR REMOVAL.

For many years it has been known that ordinary sand filters will remove from 25 to 35 per cent. of the color or vegetable stain from the applied water. Such results have been obtained at numerous places in New England. It has been the endeavor in solving many American problems to secure filtered water that does not contain more than about 10 parts per million of vegetable stain as measured by the platinum-cobalt standard. This is approximately the dividing line above which the color becomes readily noticeable to the consumer, in a glass upon the table, and especially in a porcelain bathtub. Where sand filtration will not allow of a result as good or better, there has been an effort in a number of places to employ coagulants and thus take advantage of the decolorizing effect of sulphate of alumina. This is an important factor which was considered in arriving at the recent determination in New York City to employ coagulation and mechanical filters for the treatment of the present water supply from the Croton watershed supplying the old city of New York. Sulphates of iron and lime do not ordinarily give a satisfactory color removal. This was demonstrated at Toledo and elsewhere.

In some cases intermittent filters, as at Ludlow Reservoir, Springfield, Mass., have aided in bringing about an unusually high removal of color. This seems to be due in part to an anaerobic decomposition having taken place in the water before its filtration. The color unites with iron in the water and is precipitated upon aeration. Another interesting feature that has been established at the new filter plant at Springfield is that when the coagulant is applied as an overdose to a part of the water to be treated, it is said that the mixture of the entire mass of treated and untreated water is decolorized to a greater extent by the sulphate of alumina than would be the case if the same quantity of coagulant were to be applied, at a uniform rate of dosing, to the full volume of water delivered to the purification works.

When the water to be treated contains varying high amounts of both mud and color, much care should be taken in adjusting the required dose of coagulant to the composition of the water.

MICROSCOPICAL GROWTHS.

Some years ago an unusual effort was made to prevent the appearance in water supplies of microscopical growths of algae and other organisms larger than bacteria for the sake of minimizing their influence upon objectionable tastes and odors. In some instances, particularly in Massachusetts, and with unfiltered supplies, the bottom and sides of impounding reservoirs were stripped so as to obtain in the exposed surface soil only a small quantity of organic matter. This practice has not recently been followed for the large reservoirs for the new water supply of New York City or elsewhere, particularly if the impounded water is muddy at times. It is considered better to aerate and filter the water, to correct the unfavorable influence of these growths, rather than to try to prevent them.

In America miscroscopic growths have been killed in a large number of instances through the use of copper sulphate, and to some extent by the use of hypochlorite of lime. The latter seems to have certain limitations and is not in such general use as copper sulphate.

Filters incidentally serve for the removal of microscopic growths. In some instances certain types of filamentous growths are likely to give trouble by clogging the filter. At Cincinnati experiences of this kind have been encountered, and aid has been secured through the application of hypochlorite to the unfiltered water. It is a style of problem that requires special treatment in most cases.

TASTES AND ODORS.

Many surface waters, particularly those which are not turbid, contain at times objectionable tastes and odors. The latter are sometimes due to growths of organisms themselves. In other cases they are due to the disintegration of the organisms and to the liberation of certain oils which are very penetrating in their nature. Still other objectionable tastes and odors are found in waters that have undergone anaerobic decomposition, which causes offensive gases to be liberated.

Aeration is a great help in the removal from water of those properties which produce objectionable tastes and odors. Combined with filtration, in either mechanical or sand filters, there is obtained the most practicable method of securing a satisfactory water free from tastes and odors. It is one of the characteristic features of the new Catskill supply for New York City, and is being carefully considered as an aid to the filters for the Croton supply of New York.

IRON-REMOVAL PLANTS.

There are half a dozen plants in America, mostly of small size, where ground waters are aerated, in order to precipitate the iron, and then the settled water is applied to filters. Most of the earlier filters were of the sand filter type, but a few recent ones have been of the mechanical type. It is a line of water purification upon which there is not as much experience in America as in Germany.

WATER SOFTENING.

The large water softening plant at Columbus and three or four smaller plants provide the experience up to this time in the softening of municipal water supplies in America. Many of the railroads and industrial concerns take advantage of water softening in securing satisfactory water for boiler and manufacturing purposes. Throughout the West very hard water supplies are to be found, and even in the Great Lakes district the water is much harder than it is along the Atlantic seaboard. The cost of softening very hard water supplies has undoubtedly been a factor in retarding developments along this line. Experience has shown, however, that it is a perfectly feasible matter to soften the western waters, if it is so desired.

At Grand Rapids, Mich., a mechanical filter plant that is to be used in conjunction with a softening plant is approaching completion. This plant will remove mud and vegetable color from the Grand river water, and reduce its temporary or carbonate hardness by perhaps 50 per cent., so that it will equal what is called locally the "Lake Michigan standard." The total hardness of the softened and filtered water will be approximately 125 parts per million. The reduction in hardness will be effected by lime without soda.

CORROSION OF PIPES.

Service pipes, particularly those of galvanized iron or wrought iron, are more liable to corrosion with filtered water than with unfiltered water. In part, this is due to the elimination of substances, such as silt and vegetable matter, which retard in a physical way the rate of corrosion, and, in part, it is due to an increase in carbonic acid, which, in the presence of oxygen, is a very prominent factor in influencing the total amount of corrosion, the rate of corrosion and the amount of dissolved iron which may be present in water as drawn from the faucet, and is thus the principal feature of unsuitability from the standpoint of iron stains. It is scarcely feasible to remove the oxygen present in water, and, in fact, aeration tends materially to increase the oxygen up to the limits of the saturation point of this gas.

Carbonic acid seems to be the principal feature related to the speed and amount of corrosion of iron by filtered water. Where coagulants are used, there is a corresponding increase in amount of free carbonic acid. This has led some people to consider this feature as quite a drawback to the use of coagulants. It has been studied recently in New York City from the chemical viewpoint with much thoroughness. The conclusion has been drawn that it is feasible to control the amount of carbonic acid through the proper addition of lime or soda. This feature will be an interesting part of the new Croton filter plant.

With hard waters in the South and West there has been comparatively little or no difficulty as regards corrosion of pipes by filtered water. The problem, therefore, is related more particularly to the soft waters along the Atlantic seaboard.

Speaking generally, water purification as relates to filtration is on a thoroughly well-established basis in America. The features that differ most essentially relate to preparatory treatments rather than to material differences in designs either of sand filters or of mechanical filters. The use of chemicals for purposes of coagulation and softening has been studied with considerable thoroughness in the last few years, and the problem is one that is so related to the influence of local details that each project should be carefully studied on its own merits, and no attempt made to copy blindly the style of works which may be in successful use elsewhere.

More than ever before it is now realized that the successful methods of water purification should receive intelligent management, and this is particularly the case where the type of water calls for the use of coagulating chemicals.

WATER STERILIZATION BY CHEMICAL METHODS.

S. Rideal, D. Sc., F. I. C., London, England.

Before entering on the subject it would be as well to lay down certain principles clearly, at the risk of speaking truisms:

Drinking water has got to be wholesome, not sterile. What we have to do is (1) to prevent the entrance of disease organisms,

(2) to kill them if they do enter. In both objects the engineer and the chemist must collaborate, and the bacteriologist must keep watch.

It has been many times supposed that you could get perfectly innocent water for a city by going far enough to mountain gathering grounds, collecting all the brooks into a reservoir, and sending the water down by a long conduit. Such aqueducts in Great Britain range from 43 to 99 miles. The original water of the brooks is by no means pure bacterially, owing to animals, even if the watershed is cleared of human beings. The British Local Government Board Reports give several instances of epidemics occasioned by upland water. We may presume that during the long transit the pathogenic bacteria will disappear, but this is a very expensive way of attaining the object.

Pollution of rivers, both by sewage and by manufacturing effluents, had reached a flagrant and dangerous degree, but has since been greatly abated in most countries, and by sand filtration a water of considerable purity is obtained from rivers by a majority of communities. I need hardly dwell on the obvious advantages of this course. The river is adjacent; constant attention to the cleanliness of its bed and the inoffensiveness of its water are imperative for sanitary and commercial reasons. On the other hand, a long aqueduct is enormously expensive for construction, maintenance, and care against lateral contamination, besides the fact that the water is not always initially unimpeachable. Cities and towns are built on rivers, and why should we not use the water brought to our doors? No city depending on a long conduit is safe from a water famine for three chief reasons: (1) Accident, (2) drought on the uplands, and (3) the possibility, which we may think remote, of an enemy destroying the aqueduct. The last reason led to the ruin of many cities in history.

Dependence on wells is of limited application and is notoriously unsafe; even deep wells in chalk are liable to pollution through fissures. The fact of the matter is that a system of purification is needed in all cases. Disease bacteria are apt to penetrate sand by "growing through," or by their minuteness, therefore the product of sand filtration is not always innocuous. Dr. Houston, in London, recommended storage as a method of rendering Thames water safe, but the storage must be for not less than two weeks, and might with advantage be for from one to two months. This involved the construction of enormous and costly reservoirs for London's water supply, and, in addition, the raw river water must first be passed through settling basins to remove coarser impurities. Even then, in the Seventh Report of the London Water Board, December, 1911 (p. 36), it is found that "despite the remarkable improvement effected by storage, * * * it seems unwise to trade too greatly on this circumstance if any practicable remedy, even of a partial kind, is available. Later, in the eighth report, of February, 1912, Dr. Houston, after investigation, proposes an "excess lime" method, founded on his observation that "quicklime (about 75 per cent CaO) added to raw Thames water in the proportion of 1 part of this quicklime to 5,000 parts of water, kills *B. coli* in from 5 to 24 hours * * * and inferentially, but certainly, the microbes also of epidemic water-borne disease, e. g., the typhoid bacillus." The excess of free lime is to be then neutralized by one-third of the volume of "adequately stored water," which must of course be previously examined.

This is one way of chemical sterilization which has been often tried, the attraction being the cheapness of lime and also the softening effect on the water. It is really, however, an expensive one, on account of the amount of lime needed, equal to about a ton per million gallons, and there is the need to test the water both before and after the process, and, in addition, the difficulty of getting rid of the huge deposit of carbonate of lime formed.

Several more efficient sterilizers have been introduced, but to work with economy must always have the proviso that the water is at least roughly filtered beforehand, in order not to waste the reagent on such matter as can easily be separated mechanically. The introduction of mechanical filters has made the operation comparatively simple, and enables necessary chemicals to be added under control. It has been pointed out that the unstable yet powerful bacterial toxins are not likely to be destroyed by the comparatively mild oxidizing agency of the mechanical filters, or even by the sand filters, in the winter. They are removed, neutralized, or destroyed, however, by the best methods of chemical sterilization.

We may rapidly pass in review a number of the sterilizers available under certain circumstances. In 1892 Dr. Christmas showed that 1 in 100,000 of citric acid was fatal to cholera organisms, but that ten times the quantity was required for typhoid organisms. This amount gave an acid taste, and was unduly expensive. In 1901 Dr. Parkes and myself introduced the use, for possibly polluted waters in the field, of tabloids of bisulphate of soda. These removed any danger of enteric origin.

As to copper salts, you are more familiar with their use in America than we are in Europe. I have published some researches on the point which agree with other investigators in showing that, employed in rather large proportion, they kill objectionable algæ but are not of much good against bacteria. A fault is the immediate precipitation of the copper salt by the natural carbonate of lime in the water, and, although an insoluble copper salt can act germicidally, as proved by the use for phylloxera, the action is local and irregular. The application, accomplished by towing boats with bags of sulphate of copper over the reservoir, has been expensive, and it is very difficult to make it uniform. Subsequent filtration is necessary, and there is a chance, even then, that traces of copper may remain in organic solution, so that it is fortunate that there are safer methods.

NUMEROUS OXIDIZING AGENTS HAVE BEEN EMPLOYED.

Potassium permanganate was used on a large scale for the drinking water of the soldiers in the Franco-German War of 1870, and in India it was widely applied to wells and tanks, which were regularly "pinked" by officials as a defense against cholera. Later reports on the efficiency of the practice have, however, been unfavorable. In 1899 I suggested the use of sodium peroxide; it reacted with the dissolved carbonic acid, giving nascent oxygen and sodium carbonate, so that softening and sterilization were done together. The quantity required for sterility varied between 1 in 1,000 and 1 in 10,000; cholera was killed in 8 hours, typhoid in 6. Reichel (Z. f. Hyg., 1908) found that 1 in 2,000 of hydrogen peroxide killed *B. coli* in 24 hours, and 3 in 2,000 sterilized in 6 hours. Hetsch stated that calcium peroxide was more energetic, and it was sold for the purpose under the name of "bikalzit." Magnesium peroxide (Croner, *ibid*, 1908) is made for the same object by the "Oxidinsterilisierungswerken," but is likely to introduce magnesian hardness.

Bromine (Braithwaite, Schumberg, 1897–98) and iodine (Allain at Marseilles; Vaillard, Arch. de Med. milit., 1902) have been limitedly used for water treatment in emergencies, but are objectionable. Even the fluoride and silicofluoride of silver have been placed on the market as water sterilizers under the names of "tachyol" and "isotachyol." (Gaz. Chim. Ital., 1907.)

A condition of drinking-water sterilization is that no substance should be left behind which can in any way be injurious to health, and, if possible, that nothing extraneous to the water should remain. It is at the same time a disadvantage if a disinfectant, however powerful in its first onset, is very evanescent, as many disease germs are strongly resistant, and we know that the time factor is of extreme importance in sterilization.

In the first of these conditions ozone suggests itself as an ideal reagent, producing nothing by complete oxidization of organic matter but carbonic acid and water, while the combined nitrogen is partly liberated in the free state and partly oxidized to harmless nitrates, and the organic sulphur and phosphorus give equally innocent minute quantities of sulphates and phosphates. It has been asked whether intermediate compounds might not be formed which could have some physiological effect. I have not found any such in my examinations of the process, and the water is singularly pure afterwards. Ozone is now rather extensively used in Europe for sterilizing partly purified water. In 1908 I was called upon to examine the De Frise system at the Paris water works of St. Maur, and found very successful results. The River Marne water, after ordinary sedimentation and filtration through gravel and sand, was still unfit for a supply, but by afterwards ozonizing it gave a well-aerated brilliant liquid of natural bluish tint and quite inodorous, containing per cubic centimeter only one or two innocuous organisms of the *subtilis* type. The *coli* test became invariably negative, although altogether 1,580 cubic centimeters were examined, with a maximum of 200 cubic centimeters at one test. I found that 57 kilowatt hours per million imperial gallons were required for the sterilizing operation, and 76 kilowatt hours for pumping. These figures would be reduced to 47.5 and 63.4 kilowatt hours, respectively, per million United States gallons. The De Frise apparatus used Siemens-Halske ozonizers with a simple and efficient ozonizing tower and a circuit by which ozone escaping after action was returned and used again, thereby effecting an important economy. The Paris municipality decided in July, 1910, that the part of the city drinking supply derived from the Marne (about 20,000,000 gallons daily) should, after coarse filtration, be sterilized by ozone, half by the De Frise and half by the combined Otto process. The latter employs "emulsers," which are injectors effecting a mixture of ozonized air with the water, the action being completed in "columns of self-contact." Ozone sterilization has been installed in about 30 French towns, in Roumania for the Danube, at St. Petersburg for the Neva, at two water works in Holland (the pioneer). Belgium, Germany, Italy, Spain, Brazil, and Egypt, and experiments have been undertaken at Darjeeling, in India, whilst an installation is in course of construction at the Knutsford water works, Cheshire, England.

Other processes differing in mechanical details are the Vosmaer, tried at Philadelphia, and the Howard-Bridge, at Lindsay, Ontario, Canada.

The largest plant at present is that at St. Petersburg, Russia, for 11,000,000 gallons per day. The water is first treated with sulphate of alumina, then passes on to 38 sand filters at a rate of 1,000 gallons per square meter of filtering surface per hour, and finally enters the five sterilizing towers along with ozonized air. There are 128 Siemens-Halske water-cooled ozonizers. The air is freed from moisture by refrigeration and is ozonized to the degree of 2.5 grams per cubic meter. The total cost from the raw river to the finished water was recorded in 1911 as 0.86 to 0.97 d. per 1,000 gallons. At

St. Maur, Paris, M. Colmet Daage estimated that the cost, under the most favorable circumstances, was 0.31 d. per 1,000 gallons, excluding interest, amortization, and repairs. At Nice, where cheap water power is available, the average last year was given as 0.164 d. per 1,000 gallons, and at Rimiez, where there is, besides, no pumping, it was only 0.125 d. A portable ozone purifier has been adopted by the Spanish Government for the water supply of armies in the field.

The preference for ozone as a water-sterilizing agent has been hindered by several difficulties. One is the question of expense. In this regard the manufacture has been considerably cheapened. Another is that it has to be applied in the gaseous form diluted with air, so that a large quantity of inert gas must be pumped, and with this admixture the ozone does not very readily dissolve. The latter fact has been overcome by using towers and saturators, as mentioned above. Moreover, the conversion of oxygen into ozone is a reversible action, requiring a number of precautions as to detail. In spite of the numerous researches the best conditions are not yet fully agreed on; therefore, we have not reached finality in the economy of ozone production. It is stated that "the best results ever obtained with a silent discharge apparatus gave 36.7 grams of ozone per kilowatt hour, the theoretical yield being over a kilogram." A certain amount of the loss is due to the formation of ultra-violet light in the machine. When an ozonizer is acting properly the interelectrodic space has an almost uniform violet illumination without any sparking. Regener (Ann. d. Physik, ix, 1033, 1906) showed that the presence of ultra-violet light limits the concentration of ozone within certain limits, above which it exercises a deozonizing effect. These rays are well known to have also a sterilizing action, and my son, Eric K. Rideal, has devised an apparatus in which both activities are utilized. (English patent 18680 of August, 1910.)

Siemens and Halske have several devices for preventing corrosion of the metallic parts of the apparatus. British patent 17787, of 1910, reverses the usual procedure by drawing ozonized air through the water, instead of forcing it through from below, so that the main work shall be done, and the ozone almost entirely used up, before entering the pumps. This appears expensive mechanically. Their French (international) patent 431402, of 1910, introduces small quantities of water into the pumps at the same time that the gas is admitted.

Chlorine sterilization is effected in practice by means of hypochlorites, prepared either chemically or electrolytically. It will be well known to you that "chemical chlorine," chiefly chloride of lime, is largely used in America; it is also employed at some places in Europe and in India. After three noted epidemics of typhoid in England, chloride of lime was used at Maidstone for disinfecting the mains, pipes, and reservoir; at Lincoln, for the city water supply; and, quite lately, for the same purpose at Cambridge. At Johannesburg, the Witwaterstrand supply is sterilized by the addition of chloride of lime equivalent to 0.25 to 0.5 part per million of available chlorine. (Leitch, Proc. Inst. Civ. Eng., London, 1911.)

The objections to the lime compound are avoided by electrolytic hypochlorite, which, having soda as a basis, leaves behind only an unimportant residue of common salt, and slightly softens the water, besides having apparently a somewhat greater bactericidal effect. The addition of 1 or 2 parts per million of available or active chlorine, which is all that is generally needed, does not affect the taste, and even where a water is excessively polluted, and more is necessary, the product is even then not brackish like many present supplies.

I first began trials on a large scale at Maidenhead, England, in 1898, and found that 17 parts per million of available chlorine killed in 15 minutes all the organisms in a filtered sewage effluent entering the Thames. In 1904, at Guildford, I observed that, with 2.5 parts per million, tertiary effluents were practically sterilized; in fact, were purer bacterially than the town water supply. I next tried experiments on the latter, which contained 90 organisms per cubic centimeter, with *coli* present in 4 cubic centimeters. After treatment with 0.75 part per million of available chlorine, the total organisms were reduced in 5 hours to 14 per cubic centimeter, and *coli* was absent from 20 cubic centimeters. A portion purposely infected with 100 *coli* per cubic centimeter was treated with 0.8 part per million of available chlorine, and after one hour's action there were no *coli* present in 20 cubic centimeters, and this condition remained for a considerable distance in the channel. Since then I have been directing the application of chemically prepared sodium hypochlorite to 100,000 imperial gallons daily of the drinking water supply of a north of England town with success, in the proportion of 1 to 2 parts available chlorine per million; practical sterility is attained, there are no *coli* in 75 to 85 cubic centimeters, and the taste is not affected.

Not sufficient notice has been taken of an explanation I gave, in 1909, at the Leeds Health Congress (J. R. San. Inst., London, xxxi, 2) of the fact that with hypochlorites the first rapid consumption is succeeded by a slower action, which continues for some hours or even days to favor sterility. It is due to the formation, by the action of chlorine on ammonia and nitrogenous organic matters, of strongly germicidal compounds, chiefly chloramine, NH_2Cl, and hydrazine, N_2H_4. These, in the traces present, are not injurious to higher animals, and soon disappear. The removal of any residual traces is hastened by cascades, which have also been used with success in ozone treatment.

A great advantage both of the ozone and chlorine processes is that they can be so easily controlled by the starch-iodide test. It is sufficient to observe that the reagent is faintly blued by the treated water to insure adequate sterilization. Systematic testing in this way avoids the risk of underdosing or overdosing and does away with the need of removing any excess of the sterilizing agent by a secondary treatment, such as the addition of sulphites or filtration through prepared charcoal or iron turnings and sand, processes that increase cost, time, and space required. I have found that if the process is controlled, as above, without such further treatment the water usually becomes free from odor and taste in 1½ hours.

The cost of chlorine sterilization will obviously depend greatly, among other things, on the price of materials. If one part per million of available chlorine be required, and if its cost be about £14 per ton when derived from chloride of lime, and £21 per ton when made as sodium hypochlorite (J. Soc. Chem. Ind., Jan 31, 1912), this item alone will reach 0.014 d. per 1,000 gallons of water, in the first case, and 0.022 d., in the second. The lime compound is more suitable for sewage than for drinking water, since it increases the hardness and affects the taste. There is for many reasons an advantage in making sodium hypochlorite electrically at the waterworks, especially if cheap power is at hand.

The Ferrochlor (Duyk) method adds about 8 parts of ferric chloride and 0.2 part of available chlorine as bleaching powder per million gallons of water to effect coagulation and sterility. One objection is, that it is advisable to do all coagulation and sedimentation before sterilizing in order to avoid re-contamination.

STÉRILISATION DES EAUX PAR L'OZONE, LES RAYONS ULTRA-VIOLETS ET LA JAVELLISATION.

M. Dienert, Chef du Service des Eaux d'Alimentation de Paris.

L'ozone, les rayons ultra-violets, l'eau de Javel, employés convenablement au laboratoire, tuent tous les microbes que les eaux renferment. Ce résultat est établi d'une façon indubitable.

Il s'agit de voir si, en l'état actuel, l'emploi de ces procédés de stérilisation est suffisamment pratique pour être appliqué au traitement des eaux distribuées dans les villes.

Ces divers procédés doivent, en effet, répondre à plusieurs conditions au point de vue pratique:

1. Les appareils doivent être suffisamment robustes et être d'un fonctionnement régulier;
2. Leur entretien doit être facile;
3. La stérilisation doit se faire avec beaucoup de régularité;

4. La surveillance de l'installation doit être la plus simple et la plus facile que possible;

5. La malveillance ne doit pas être à craindre;

6. Le réactif employé doit également disparaître après avoir agit.

Nous allons voir si les procédés actuels de stéralisation de l'eau par l'ozone, les rayons ultra-voilets et par l'eau de Javelréspondent à ces divers desiderata.

Stérilisation par l'ozone.—Une installation de stérilisation par l'ozone comprend: (a) Un transformateur de courant; (b) un aspirateur ou compresseur d'air; (c) un desséscheur d'air; (d) des ozoneurs; (e) des colonnes d'ozonisation; (f) une chambre pour le départ de l'ozone.

Les transformateurs de courant doivent permettre d'envoyer dans les ozoneurs un courant électrique de 6,000 à 20,000 volts et de 400 à 500 périodes. On trouve dans l'industrie de telles machines électriques qui, bien calculées, fonctionnent très régulièrement.

Le gaz qu'on va envoyer dans les ozoneurs est puisé directement dans l'air, soit au moyen d'aspirateurs (système de la Compagnie Générale de l'Ozone), soit au moyen de compresseur (système Siemens, De Frise).

Les deux systèmes fonctionnent régulièrement. Le compresseur d'air est cependant plus robuste que l'aspirateur, mais il est d'une construction un peu plus onéreuse. L'air aspiré est desséché soit dans des colonnes chargées de chlorure de calcium, système le plus simple pour petites exploitations, soit en passant sur des serpentins métalliques refroidis au moyen de chlorure de méthyle détendu ou d'ammoniaque liquide, dans les exploitations importantes.

La dessication du gaz est importante parce que l'air humide, arrivant dans les ozoneurs, favoriserait la formation d'étincelles et donnerait un très mauvais rendement en ozone. La dessication doit abaisser de moitié la tension de la vapeur d'eau existant dans l'atmosphère.

La dessication au chlorure de calcium, si elle est plus simple à établir et plus facile à installer, est généralement moins parfaite que celle obtenue au moyen de serpentins refroidis.

L'air humide, passant sur du chlorure de calcium, s'échauffe assez fortement, et il est alors indispensable de la refroidir avant de l'envoyer dans les ozoneurs.

Les ozoneurs, actuellement employés, sont de deux types: l'ozoneur plat et l'ozoneur rond. L'ozoneur plat, qui est celui de Marmier et Abraham, est formé de deux caisses métalliques creuses, séparées par deux plaques de verre formant diélectriques. Ces deux plaques de verre sont espacées de 2mm. environ et c'est dans cet intervalle que l'effluve jaillira et que l'air se chargera d'ozone. On refroidit les électrodes au moyen d'un courant d'eau passant dans l'intérieur des deux caisses métalliques (ozoneur Siemens, ozoneur Léo Girard, ozoneur Steynis).

Dans l'ozoneur rond on place au centre une électrode ronde en aluminium, on introduit ensuite celle-ci dans un manchon en verre ou en mica, rond, dont elle est éloignée de 1 mm. 5 à 2 mm. Le tout est placé dans une cuve pleine d'eau qui sert au refroidissement des électrodes. L'électrode en aluminium constitue un pôle, l'eau de la cuve est reliée à l'autre pôle du transformateur ou à la terre, si le deuxième pôle du transformateur est relié au sol.

Les ozoneurs ronds ont certains avantages et certains inconvénients, de même les ozoneurs plats.

Les premiers sont d'un montage facile et rapide quand on a centré exactement l'électrode en aluminium dans le manchon en verre ou en mica. Ils fontionnent à un voltage moindre que les ozoneurs plats; ils sont moins chers également à construire. Ils ont toutefois le désavantage de ne pouvoir fonctionner à forte tension, ce qui diminue le rendement en ozoine.

La surface de l'électrode s'altère, généralement, toujours sur un côté seulement. Elle se recouvre d'un enduit gras et de quelques efflorescences d'alumine. Il faut nettoyer assez régulièrement ces électrodes sinon l'effluve n'est plus régulière, il commence à apparaître de petites étincelles violettes qui deviennent plus blanches au fur et à mesure que le tube d'aluminium se salit. Le rendement en ozone diminue, tandis que le taux des composés nitrés augmente.

Quand on augmente la tension électrique l'enduit gras, sur la surface de l'électrode en aluminium, augmente et il se produit en outre des étincelles qui peuvent devenir dangereuses pour la solidité du manchon en verre qui casse alors rapidement.

Les ozoneurs plats, moins économiques que les ozoneurs ronds, donnent une effluve régulière, et marchent à plus forte tension (15,000 à 18,000 volts). Ils fournissent un air ozoné beaucoup plus riche en ozone que les ozoneurs ronds (5 grammes au lieu 2 grammes).

Cependant l'isolement des deux électrodes est assez délicat et souvent, par suite de condensation, il se forment des courts circuits qui cassent les glaces des cages des ozoneurs.

Les électrodes doivent être bien parallèles, les lames de verre bien planes. Les réparations de ces ozoneurs en cas d'accident sont toujours plus longues que pour les ozoneurs ronds.

Le refroidissement de l'électrode se fait avec de l'eau. La température habituelle de refroidissement est de 15 degrés. Toutefois, certains industriels refroidissent leurs ozoneurs à—5 degrés. Le rendement en ozone est évidemment plus fort, mais au point de vue économique il n'est pas établi que le refroidissement par une saumure glacée est meilleur que le refroidissement par l'eau seule.

L'air ozoné, à la sortie des ozoneurs, doit être le moins possible en contact avec leur métal. Ces canalisations sont en fonte, ou en grés de préférence, avec joints en ciment.

L'ozoneur est une des parties principales de l'installation. C'est en grande partie de lui que dépend le succès de la stérilisation. En l'état actuel ces instruments fonctionnent avec une régularité suffisante pour être appliqués en pratique. Toutefois, il est à souhaiter qu'on perfectionne encore leur construction dans le but d'éviter, soit la complication de leur installation, soit les nettoyages fréquents des électrodes.

L'air à la sortie des ozoneurs renferme suivant les cas de 0 mmgr. 2 à 7 mmgr. d'ozone par litre. Sa teneur en azote nitreux est variable également. Quand l'ozoneur fonctionne bien on trouve 0 mmgr. 2 à 0 mmgr. 3 d'azote nitreux, mais aussitôt qu'il rend moins d'ozone, comme, par exemple, quand l'air est trop humide, on voit l'azote nitreux augmenter et atteindre le chiffre de 1 mmgr. à 1 mmgr. 2 par litre.

L'air ozoné arrive ensuite dans la colonne d'ozonisation. Celles-ci ont pour but de mettre en contact continue l'eau polluée avec l'air ozoné.

Ces colonnes tendent à s'uniformiser de plus en plus. On a renoncé pour ainsi dire à la colonne de Gay Lussac préconisée par MM. Abraham et Marmier. Cette cuve remplie de gros cailloux sur lesquels l'eau ruisselait, tandis que l'air ozoné, arrivant par la partie inférieure, léchait la surface de l'eau en remontant à la surface de la cuve, occupait une place assez grande. Pour de petites installations cette colonne de Gay Lussac peut être employée à la rigueur, mais pour les grandes usines de stérilisation on a préféré s'adresser soit à la colonne de self-contact, soit à la colonne De Frise, soit enfin à l'ancienne colonne de Tyndall.

La colonne de self-contact n'est autre qu'une cuve cylindrique verticale de 4 à 5 m. de hauteur, dans laquelle l'eau arrive à la partie inférieure mélangée avec de l'air ozoné. L'air est émultionné dans l'eau, avant son arrivée à la colonne de stérilisation, au moyen d'un émulseur qui n'est autre qu'une trompe à eau aspirant l'air ozoné.

Ce système employé à St. Pétersbourg et au camp de Villefranche donne des résultats satisfaisants, moins bons cependant que la colonne De Frise. Celle-ci est également une cuve verticale de 4 m. de hauteur dans laquelle sont disposés deux ou trois plateaux horizontaux percés de trous.

Dans les premiers essais les plateaux étaient en celluloïde. Dans les installations définitives ces plateaux sont formés de dalles en ciment armé percées de trous ayant environ 5 à 6 mm. de diamètre. l'épaisseur des dalles étant d'environ 5 à 6 cm. Dans d'autres installations, à St. Maur par exemple, ces plateaux sont formés de barreaux.

également en ciment armé, supportant une petite couche de gros graviers.

À St. Maur, la Compagnie Générale de l'Ozone a même allié l'émulseur à la colonne De Frise. L'expérience a montré jusqu'ici que ce dernier dispositif donnait de bien meilleurs résultats que la colonne de self-contact.

Enfin l'ancienne colonne Tyndall, reprise par M. Steynis, consiste à faire arriver l'eau à traiter par la partie supérieure de la colonne d'ozonization tandis que l'air ozoné arrive par la base. L'eau tombe en pluie sur deux plateaux superposés recouverts de cailloux.

Pour obtenir un maximum d'action de l'air ozoné sur l'eau il faut que le contact entre l'air et l'eau soit aussi intense que possible et que le temps d'action soit suffisant.

Dans la colonne de self-contact ou dans la colonne De Frise, ce temps de contact est d'environ quatre à cinq minutes.

Dans la colonne Tyndall elle n'est au maximum que de une minute. En outre, la présence de ces couches de cailloux oppose une résistance assez grande à l'écoulement de l'eau. Aussi, en l'état actuel des dispositifs employés donnons-nous la préférence à la colonne De Frise associée ou non à l'émulseur, qui assure le meilleur contact de l'eau avec l'ozone pendant un temps suffisant.

L'inconvenient de l'emulseur est la nécessité d'élever l'eau à une hauteur suffisante pour lui permettre de fonctionner comme trompe. L'émulseur est en poterie et constitue un organe fragile et assez difficile à construire. La colonne De Frise est plus rustique et plus simple à construire.

Pour conduire l'air ozoné des ozoneurs aux colonnes de stérilisation on tend de plus en plus à supprimer toute conduite métallique et à employer exclusivement la poterie.

De même pour la sortie de l'eau des colonnes il ne faut employer que de la poterie. Dans l'installation de Chartres, où on avait employé le plomb, on a constaté dans l'eau traitée la présence de nitrate de plomb dangereux pour la santé publique.

L'eau, sortant de la cuve de stérilisation, tombe en cascade de façon à laisser dégager l'ozone en excès. En arrivant dans les conduites l'eau ozonée n'a plus aucune odeur perceptible et ne possède plus le goût spécial de l'eau traitée.

Doit-on refaire passer l'air ozoné se dégageant de l'eau dans les ozoneurs après l'avoir désséché, ou bien doit-on laisser l'excès d'ozone se dégager à l'air libre?

Dans les installations actuelles on a toujours préféré laisser l'ozone se dégager à l'air libre. La raison en est que les installations à faire pour récupérer cet excès d'ozone sont assez dispendieuses, et d'autre part la forte humidité de l'air ainsi reprise, est plus grande que celle de l'air atmosphérique, d'où augmentation de dépense dans la dessication de l'air. Mais l'inconvénient de ce procédé est de laisser l'eau exposée aux poussières de l'air extérieur. On emploie en général ½ mc. d'air par mètre cube d'eau à traiter. Toutefois, ceci dépend beaucoup de la richesse de l'air ozoné. Il faut en moyenne 0 gr. 5 à 1 gr. d'ozone par mètre cube d'eau traitée.

Une usine d'ozonisation doit être surveillée à chaque instant. On doit savoir:

(a) La quantité d'eau traitée par heure;

(b) La quantité d'air ozonée envoyée en une heure dans les colonnes de stérilisation;

(c) La teneur en ozone et en composés nitreux de l'air sortant des ozoneurs;

(d) L'humidité de l'air admise aux ozoneurs;

(e) La température de l'air ozonée et de l'eau après refroidissement des électrodes;

(f) Le voltage aux bornes des ozoneurs, l'intensité et l'énergie dépenses. Ces dernières données étant indiquées par des appareils enregistreurs plombés;

(g) La composition bactériologique de l'eau avant et après traitement;

(h) La composition minérale sommaire (alcalinité ou résistivité électrique, matières organiques) avant et après traitement de façon à s'assurer de l'authenticité de l'eau et des facteurs qui peuvent faire varier la dose d'ozone à employer. On constate aussi s'il reste de l'ozone à la sortie des colonnes de stérilisation;

(i) La limpidité de l'eau à traiter (une eau trouble demandant pour être stérilisée une quantité plus grande d'ozone que l'eau claire.

Enfin, pour la sécurité de la marche de l'usine, il faut que l'eau soit mise en décharge au moyen d'appareils automatiques au moment de la mise en marche de l'usine et au moment où le courant vient d'être coupé. Le fonctionnement de cet appareil automatique doit être contrôle par un appareil enregistreur plombé.

La stérilisation d'un mètre cube d'eau par l'ozone revient environ à 1 ou 3 centimes, sans tenir compte des frais d'amortissement des appareils sur lesquels on est peu fixé. Ce prix est relativement économique et fort acceptable.

Les appareils amployés sont relativement robustes et leur fontoinnement est assez régulier. Évidemment, comme dans toute usine, il y a quelques défectuosités de fonctionnement, mais en ayant soin de prévoir quelques batteries d'ozoneurs supplémentaires, ainsi qu'un nombre suffisant de machines électriques de rechange, on peut avoir confiance dans ces procédés de stérilisation qui ont fait déjà leurs preuves en pratique.

C'est même le procédé de stérilisation qui répond le plus complètement aux conditions énumérées au commencement de notre manuscrit. Son entretien n'est pas plus compliqué que celui de toute usine électrique, la surveillance est facile et efficace si elle est aussi complète que nous l'avons indiquée, et il n'y a pas à craindre de malveillance si tous les appareils enregistreurs sont plombés.

On peut craindre en effet que la nuit, si l'usine est insuffisamment ventilée, que les ouvriers modèrent la formation de l'ozone de façon à ne pas être incommodés par son dégagement. Quand l'air est humide, on constate en effet que l'odeur d'ozone augmente et devient pénible. Les appareils enregistreurs permettent de se rendre compte de la marche de l'usine et celui qui est chargé du contrôle peut demander la raison des changements dans le régime qu'il a constaté aux appareils enregistreurs.

Les villes françaises employant l'ozone pour le traitement de leurs eaux sont: Paris, Nice, Chartres, Cosne, St. Brieux, etc.

Les résultats bactériologiques obtenus sont très bons quand l'installation est bien surveillée, et les germes pathogènes sont tués complètement.

Stérilisation par les rayons ultra-violets.—L'expérience montre que les rayons ultra-violets sont très microbicides. En pratique il faut que l'eau soit aussi claire que possible afin que les rayons puissent atteindre les germes et les détruire. L'eau ne doit être, ni fluorescente, ni colorée, ni jaune, couleur très absorbante pour les rayons ultra-violets.

L'appareil destiné à stériliser les eaux doit répondre aux conditions suivantes:

1. Le temps de contact de la lumière ultra-violette avec l'eau devra être suffisant pour tuer les microbes;
2. L'allumage de la lampe doit être facile;
3. Un dispositif devra permettre l'arrêt de l'eau quand la lampe ne fonctionnera plus;
4. Le contrôle du dispositif d'arrêt est également nécessaire;
5. Les rayons ultra-violets étant très nocifs pour les yeux l'appareil devra être complètement clos;
6. Il devra se démonter très facilement;
7. On doit pouvoir contrôler à chaque instant le rayonnement des lampes.

En principe une lampe en quartz se compose d'un tube terminé à ses deux extrémités par un réservoir en quartz également. Des électrodes en acier invar (ayant comme le quartz un très faible coefficient de dilatation) plongent dans chacun des réservoirs placés aux extrémités.

Dans l'intérieur de la lampe on introduit du mercure, puis on fait le vide. La lampe, fermée aussitôt le vide obtenu, peut fonctionner si on la met en circuit sur du courant continu.

Le voltage nécessaire peut être suivant les lampes de 110, 220, 550 volts.

Pour mettre la lampe en marche on la fait basculer de façon à faire arriver du mercure pour provoquer un court circuit. Le mercure s'échauffe et la vapeur de mercure ainsi produite suffit alors pour faire passer le courant à travers la lampe. La lumière, d'abord bleue et de faible intenité, augmente peu à peu d'éclat. Après 10 à 20 minutes de marche suivant la lampe, celle-ci atteint son régime maximum et normal.

Le mercure qui sert à la confection de ces lampes doit être très propre et exempt de cuivre ou de plomb. Des traces de ces métaux viendraient salir le quartz après quelque temps de fonctionnement et intercepteraient ainsi l'émission des rayons ultra-violets.

La lampe en quartz s'échauffe lors de son fonctionnement. Elle émet d'autant plus de rayons ultra-violets que la température de la vapeur de mercure est plus élevée.

Le quartz porté au rouge peut être immergé dans l'eau sans casser.

On distingue deux sortes d'appareils à stériliser l'eau : Dans les uns la lampe se maintient en dehors du contact direct de l'eau. Dans les autres la lampe plonge dans l'eau.

L'eau absorbe peu de rayons ultra-violets moyens; ceux-ci émis par une lampe placée au-dessus du liquide peuvent pénétrer pratiquement jusqu'à 30 centimètres.

L'eau à traiter doit être, s'il y a lieu, clarifiée le mieux possible, toute particule en suspension ou tout colloïde pouvant former écran à la lumière. Certaines eaux claires à la source se troublent pendant leur circulation à l'air libre, les eaux ferrugineuses par exemple. Elles devront être aérées fortement pour oxyder les sels ferreux filtrées ensuite et traitées par les rayons ultra-violets.

Les eaux, mêmes claires, colorées très faiblement en jaune, doivent être traitées par le sulfate d'alumine, puis filtrées afin d'entraîner la matière colorante.

Dans le procédé de la Société Westinghouse, la lampe est placée à 1 ou 2 centimètres au-dessus du niveau maximum de liquide qui circule dans une caisse métallique. Celle-ci était en cuivre étamé. L'expérience ayant montré que l'étain s'altérait fortement, on emploie actuellement du cuivre argenté.

Pour mieux utiliser les lampes on fait circuler l'eau au-dessus et au-dessous, et la lampe est placée à l'intérieur d'une cuve en quartz. Par un système de chicanes placées dans la cuve les particules du liquide passent tout près de la lampe trois ou quatre fois pendant le trajet. Le séjour dans cette boîte fermée est de 4 à 5 secondes environ.

Avec les lampes nouvelles dites "pistolet" le tube de quartz est recourbé en U. Le rayonnement en rayons ultra-violets de ces lampes, fonctionnant avec 550 volts, est 10 à 12 fois plus élevé que celui d'une lampe fonctionnant avec 220 volts.

À la sortie de l'appareil est placée une soupape de décharge, maintenue fermée par un ressort tendu par un fort, électro-aimant qui fonctionne, quand le courant passe. Si la lampe s'éteint, le courant électrique s'arrête, la soupape de décharge s'ouvre et l'eau s'en va à la décharge. L'appareil est clos et facilement démontable. L'eau passant près des glaces s'échauffe peu.

Les avantages et les inconvénients de ce système sont les suivants:

1. Ces lampes sont fabriquées avec soin;
2. Le dispositif permet de remplacer facilement les lampes qui perdent de leur pouvoir en lumière ultra-violette;
3. On a prévu la mise en décharge automatique de l'eau non traitée en cas d'arrêt du courant et un contrôle permanent du rayonnement des lampes;
4. Il faut éviter la formation de buées dans l'intérieur des cuves de quartz qui gènent le rayonnement;
5. La présence assez fréquente de petites bulles de gaz dans l'eau gène également l'action bactéricide des rayons lumineux;
6. Le dispositif de régulateur permet bien l'envoi à l'égout des eaux quand la lampe vient à s'éteindre, mais à chaque arrêt il faut 10 à 25 minutes pour que le pouvoir bactéricide soit maximum. Aucun dispositif n'est prévu pour empêcher l'envoi dans les canalisations de ces eaux insuffisamment traitées;
7. Ces appareils demandent une surveillance attentive, le remplacement des lampes usées et une filtration préalable pour empêcher les eaux louches ou les algues en suspension.
8. Les lampes s'usent par suite des entrées d'air. Celles-ci résultent des étincelles fréquentes dues, la plupart du temps, aux variations trop fortes de voltage du réseau électrique; le joint au mercure qui complète le joint rodé de l'acier invar sur le quartz est insuffisant pour empêcher les rentrées d'air à chaque extinction. La soudure directe du quartz et de l'électrode serait un grand progrès dans la confection de ces lampes. Malheureusement on n'est pas encore bien fixé sur le valeur pratique de cette soudure;
9. Dans le montage de l'appareil il faut faire très attention de ne pas salir, non seulement la lampe, mais encore les glaces, avec les doigts, sinon son effet bactéricide est diminué.

Les examens bactériologiques, obtenus dans des essais faits en grands (400 mc. à 2,000 mc. par jour), ont montré des résultats encore insuffisamment constants. Le bacille Coli n'est pas toujours certainement détruit, et le nombre de germes varie, dans l'eau traitée, de 5 à 60 au cc. (Numération après 15 jours.) On consomme environ 40 watts pour traiter un mètre cube d'eau claire. Cet appareil n'est donc pas encore complètement au point dans la pratique. Il a le grand avantage d'être simple et de ne pas tenir beaucoup de place. Enfin il n'introduit dans l'eau aucune substance chimique quelconque et, de ce fait, s'il était tout à fait au point, jouirait auprès des municipalités, d'une certaine vogue.

La lampe Billon Daguerre est une modification de la lampe de la Société Westinghouse. La manchon de quartz, isolant la lampe du contact de l'eau, est soudé à la lampe. On fait ensuite le vide dans ce manchon, d'où l'avantage d'éviter la présence de l'air qui absorbe en partie les rayons ultra-violets. Lors de la confection de la lampe, on remplit le tube d'hydrogène et on fait le vide ensuite après l'introduction du mercure. Cette précaution aurait pour but de permettre à la lampe de supporter une variation très forte du voltage du circuit sans s'éteindre. Elle s'allume aussi plus facilement. Certains physiciens prétendent qu'elle donne un rayonnement moindre en rayons ultra-violets.

L'appareil Billon-Daguerre est aussi plus simple. Il place dans une grande cuve deux lampes en parallèle, aussi près possible l'une de l'autre. Au moyen d'un tube évasé il vient prendre l'eau au voisinage même de ces deux lampes. De cette façon il ne prend que l'eau ayant subi le voisinage du rayonnement des lampes.

Jusqu'ici cependant les analyses bactériologiques n'ont pas donné, avec cette lampe, des résultats meilleurs qu'avec les lampes de la Société Westinghouse.

L'appareil Triquet est à lampe immergée. La lampe est placée dans un cylindre métallique étamé dans lequel l'eau circule. Une chicane force l'eau à passer près de la lampe. Cet appareil a les mêmes inconvénients que les précédents. La plongée des lampes dans l'eau restreint leur durée d'action pour plusieurs raisons; la casse est ici plus fréquente; il se forme un dépôt calcaire sur les lampes qui empêche ou restreint son rayonnement actif: enfin les lampes s'usent plus vite par suite de l'altération des mastics qui maintiennent le vide à leur intérieur.

Les résultats bactériologiques sont avec ces derniers appareils inférieurs à ceux obtenus avec les deux précédents.

Tous ces appareils coutent chers; la durée d'une lampe est, en moyenne, limitée à 2,000 ou 3,000 heures de marche active. À ce moment le brûleur devient jaune; il demande alors un nettoyage et une régénération. Celle-ci est assez délicate et coûteuse.

En résumé, si la stérilisation pas les rayons ultra-violets semble être un procédé des plus intéressants, on ne peut dire actuellement qu'il est au point pour être appliqué avec sécurité en pratique.

Javellisation.—Le traitement de l'eau par l'eau de Javel (hypochlorite de soude) ou par l'hypochlorite de chaux est surtout employé en Angleterre et en Amérique. Il a été appliqué l'an dernier en France—à Paris, et à Marseille—comme procédé de fortune. En effet le procédé est excessivement simple à appliquer, sans appareil ni installation spéciale.

Au moyen d'un vase de Mariotte, ou par l'intermédiaire d'un tonneau renfermant la solution d'hypochlorite dont on maintient le niveau constant, on verse d'une façon continuée et régulière la solution d'eau de Javel dans l'eau suspecte.

Soit au moyen de chicanes, soit au moven d'un barbotteur mécanique, on rend intime le mélange de l'eau et du réactif. La dose d'hypochlorite à employer varie suivant la composition chimique de l'eau. Elle est pour les eaux de source de 1 à 2 mmgr. de chlore libre par litre. Elle doit être de 3 et 5 mmgr. de chlore libre par litre dans les eaux de rivières riches en matières organiques si on veut, non seulement détruire le Bacille coli, mais encore la majorité des espèces banales et ramener leur nombre à quelques unités.

Le contact du chlore libre doit être au moins de trois heures pour être efficace. Après ce temps l'eau renferme encore du chlore libre et possède une odeur caractéristique de lessive.

Quand l'eau traitée est mélangée ensuite à d'autres eaux non suspectes et non traitées le chlore disparaît par suite de la présence des matières organiques dans les eaux non traitées qui absorbent alors le chlore.

Mais si le mélange est impossible il faut éliminer l'excès de chlore par un traitement approprié. Le corps le plus simple et le plus facile à employer est le sulfite de soude qui se dissout assez rapidement dans l'eau chaude et qui se transforme en un corps tout à fait inoffensif qui est le sulfate de soude. On peut encore employer l'hyposulfite de soude, soit même en plongeant des plaques d'aluminium dans l'eau, soit encore le sulfate ferreux. Ce dernier donnerait à l'eau un léger louche d'oxyde de fer.

L'addition de sulfite de soude se fait comme il a été dit pour l'hypochlorite de soude. On fait une solution renfermant 10 pour cent de sel hydrate à 5 molécules d'eau. On dose le chlore libre dans l'eau avant addition de sulfite au moyen d'acide arsénieux et d'iode en présence d'amidon. On dose également de sulfite de soude au moyen d'iode en présence d'amidon. On connait le débit de l'eau à traiter et sa richesse en chlore libre, on sait ainsi combien il passe de chlore par seconde. On ajoute alors, par seconde, un volume de la solution étendue de sulfite de soude de telle façon qu'elle fasse disparaître complètement tout le chlore et qu'il reste dans l'eau un petit excès de sulfite (0 mmgr. 1 d'acide sulfureux par litre). Si même le petit excès de sulfite n'était pas oxydé par l'air (ce que nous n'avons pas constaté) cette faible dose d'acide sulfureux serait bien inférieure à celle qu'on trouve dans le vin blanc de Sauterne.

Au contraire, le chlore libre, même à la dose de 0 mmgr. 5 et 0 mmgr. 2 par litre dissout facilement le plomb des conduites. Le chlorure de plomb ainsi formé se dissout dans l'eau et peut amener des perturbations dans l'organisme. Il vaut donc mieux distribuer de l'eau contenant 0 mgr. 1 d'acide sulfureux que de l'eau renfermant 0 mmgr. 1 de chlore libre. On a objecté que l'hypochlorite renfermait de l'arsenic. Ce dernier corps est à l'état de traces et se dilue beaucoup, par conséquent devient inoffensif. L'arrivée et le mélange de l'eau contenant du chlore avec la solution de sulfite de soude se fait, comme il a été dit, pour le versement de l'hypochlorite.

En opérant convenablement et en enlevant complètement le chlore libre de l'eau traitée, on ne distribue que de l'eau pure et n'ayant pas le goût de lessive. Mais, opérant sans appareils spéciaux, il faut une surveillance constante du versement et de la richesse du réactif en chlore, au poste amont; du sulfite de soude, au poste aval. Il faut donc un personnel consciencieux actif, et une organisation de courrier destinée, en cas de fausee manœuvre, à prévenir le poste aval en temps utile afin qu'il augmente immédiatement la dose de sulfite de soude quand arriverait une trop grande quantité de chlore. Il faut ensuite un service de contrôle des opérations faites par les chimistes placés auprès du poste de versement de l'hypochlorite et au poste de versement du sulfite de soude.

Cette surveillance doit s'exercer le jour comme la nuit. Elle est en outre coûteuse. En revanche les réactifs sont peu coûteux. A Paris, en 1911, le prix du traitement de 120,000 mc. d'eau par jour revenait à 600 frs. environ soit 0 frs. .002 par mètre cube. C'est donc le traitement le plus économique que l'on connaisse malgré une surveillance extrêmement active et serrée.

Au contraire, dans une petite ville le prix du traitement augmentera en raison même de la surveillance qui est proportionnellement plus coûteuse. Ainsi pour une ville de 10,000 habitants recevant 1,000 mc. d'eau à traiter l'hypochlorite et le sulfite de soude le traitement reviendrait à 8 centimes le mètre cube.

En raison de cette surveillance incessante et pénible quand le traitement se prolonge, par suite du relachement toujours à craindre dans l'attention du personnel, nous estimons que ce traitement à l'hypochlorite ne peutêtre qu'un procédé de fortune, applicable au moment où les eaux deviennent suspectes.

Mais c'est un procédé dangereux et dont il faut se méfier en raison du chlore qu'on peut laisser dans l'eau et qui, attaquant les conduites en plomb, intoxiquerait plus ou moins la population.

En résumé, en l'état actuel de la science, quand on est dans la nécessité de traiter une eau d'alimentation suspecte d'une façon temporaire, le procédé le plus économique, s'il est bien surveillé par un personnel compétent, est l'hypochlorite de soude ou de chaux.

Au contraire, si le procédé doit être permanent l'ozone est actuellement plus pratique, sinon plus économique, que les rayons ultraviolets.

DISCUSSION.

Prof. Dr. **August Gaertner**: So many topics have been referred to in these papers, and so many possible points of attack presented, that I am at a loss to pick out those points that appear especially to call for discussion.

Of course the sanitary supervision of the water supply of large cities is a very important matter. It is also a difficult one. Nowhere is the matter perfectly handled. But great steps forward have been taken toward the elimination of water-borne diseases, such as typhoid.

When my colleague, Houston, who has contributed so much of value to this subject, tells us that the storage of water kills off many disease germs, I agree with him. We must, however, be very cautious in this matter. There are well-authenticated instances on record in which certain bacilli of typhoid fever have persisted during several weeks. Take the case of Tavel in which the typhoid bacillus persisted for several months in the end of a " dead end " of a water pipe.

The water from flowing streams especially needs to be sterilized even if it has been subjected to storage, in order that absolute certainty may be attained with regard to its freedom from disease germs. In the case of water that comes from ponds and reservoirs it is possible of course that this water is sufficiently purified by storage alone, for it has not come into contact with human habitations.

Great importance should be attached to the qualities of the water after it has been subjected to storage and the different methods of sterilization. It is important to know how it changes the taste, the color, the hardness of water after treatment. It will be interesting to know what has been the experience of the United States in this regard. In Germany we have had some rather unfortunate experiences along this line, for there it has been frequently found that the storage of water gives rise to the objectionable development of flora and fauna. This is a serious difficulty. What is your American experience in this regard? I understand that your Department of Agriculture has given great attention to the copperization of water.

Purification by ozonizing has as a rule worked very well. In one European city the number of germs was reduced after the application of ozon to 10 and ultimately to even 3 per cubic centimeter. Further developments indicated in one instance that one coli bacillus per cubic centimeter had been found in the water, and even this was objected to. That, in my opinion, is carrying a joke too far.

Of course further technical progress must be made in the sterilization of water. At the Hygienic Institute. at Jena, our experiences with ultra-violet rays have not been very satisfactory. Nominally we had three sets of apparatus for sterilization by means of ultra-violet rays. But nearly all the time one of these was being made ready for use and was not yet available; another was actually in service; and the third was already out of commission. Of course, in the application of any new method, it frequently happens that there are many difficulties in the early stages, since every new process has to pass through what may be called the diseases of infancy. But there appears to be something inherently unsatisfactory in the ultra-violet process: the glass gets "blind," and other difficulties are constantly arising.

As for the chlorine process, that method, which I understand is so common in this country, has reached the Continent, and very properly so. It has the very important advantage of certainty, rapidity, and economy. The ozonizing method is very sure, but in some instances costly. In the Ruhn region of Germany, where nine-tenths of the water is used for industrial purposes and one-tenth for domestic purposes, there are towns using the chlorine process with good effect. In such cases it would scarcely appear justifiable to incur the relatively higher cost that is involved in the use of the ozonification process.

George A. Johnson, New York: During the past 10 years many advances have been made in the field of water purification, not the least of which is the development of the art of water sterilization to a stage of sound practicability.

As early as 1840, Frederick Schonbein, by subjecting oxygen to electrical stress, produced a gas which he named "ozone." For many years this gas remained little more than a scientific curiosity, but, beginning in 1890, the studies of Berthelot and a number of other investigators were directed to the utilization of ozone for practical ends.

It has been shown conclusively that ozone is an exceedingly active germicide, and that, when it is applied for the purpose of water purification, the pathogenic germs are among the first to be destroyed. During the past 20 years a number of ozonizing plants have been installed in Europe and in America, and the subject has received extended experimental study.

Unquestionably the main weaknesses in the ozone treatment of water lie in the difficulty of constantly effecting a perfect mixture of the ozonized air with the water; failure of the producers to yield without interruption a constant quantity of ozone; and, finally, the cost of the treatment. It is true that during the past few years there has been marked improvement both in the apparatus and in methods of mixing the ozonized air with the water, and it may be that in the not far-distant future the ozonization of water for sterilizing purposes will be found practicable from standpoints both of efficiency and cost. It is to be admitted, however, that, in view of the results which have been thus far obtained, the prospects are not particularly alluring.

Other germicides referred to by Dr. Rideal for use in the treatment of water have been forced into the background because of their ineffectiveness or their high cost. Potassium permanganate, for example, has never been used with marked success, on account of its cost and slow action. The "excess lime" method is certainly not particularly effective, and entails high cost of operation and maintenance, because of the large quantities of lime ordinarily required, and on account of the huge precipitate which results from the treatment. Copper compounds have received a great deal of attention during the past 10 years, particularly as destroyers of objectionable algæ; but their use is water purification practice for the destruction of pathogenic bacteria is, except by a limited few, not now looked upon with favor. Aside from questions of cost, there is the as yet unanswered question of whether these compounds, used continually in the quantities required for the effective destruction of pathogenic bacterial life, do not leave behind objectionable substances which may even be classed among the accumulative poisons. This latter point, more than anything else, in all probability, appears to have served to relegate copper salts to the background as effective and harmless germicides in the sterilization of public water supplies. The "ultra-violet rays" method promises much, but is still in the experimental stage.

We now come to a process which, in the past four years, has been shown to be markedly superior to any other in the sterilization of large public water supplies. This is the so-called chlorine process, in which hypochlorite of lime, in the form of a powder, or hypochlorite of soda, in the form of a liquid, is used.

It is a well-known fact that, as deodorizers, hypochlorites have had some standing for the past 50 years, and, as sterilizing agents, particularly in sewage treatment, for something over 20 years. One of the first examples of the utility of hypochlorite as a water sterilizer was recorded at Maidstone, England, in 1897, and later the same germicide was used with success in connection with water supplies at a number of other places. It was not until 1908, however, that the movement was started which has resulted in the adoption of this method of water sterilization by scores of cities in America and in Europe.

Up to the time of installation, in the autumn of 1908, of the hypochlorite plants in connection with the purification of the water supplies at the Chicago stockyards and in Jersey City, the whole question of the utility and economy of the hypochlorite process was on an insecure and not well understood basis. The results obtained at the two places mentioned, however, were given wide publicity, and it was in many ways fortunate that the use of the process at both Chicago and Jersey City was the subject of more or less extended litigation, particularly in Jersey City. In the latter case, extended testimony was taken in the court of chancery of New Jersey before Special Master Ex-Chancellor Magie, and some 25 or 30 of the leading sanitarians of America were called upon to testify. The thorough effectiveness of the process was thus completely brought out and its chemistry and biology placed on a sound and well-understood basis. Advantage was immediately taken of this, and whereas ordinarily such radical innovations in water-purification practices require many years for their development to a point of full understanding, within a year's time the process began to be adopted throughout the length and breadth of America. It is impossible to state definitely the number of cities in this country and in Europe where the hypochlorite process is being used at this time, but between one and two hundred large cities, at least, are known to be employing it.

The points in favor of the process lie in its ease of application; the quick germicidal action of the chemical; the selective action of the chemical, in that the pathogenic germs are among the first to be destroyed; the entire absence of poisonous features, there being left in water treated with hypochlorite no substances which are deleterious to the consumer; and, finally, the low cost of installation and operation of the necessary works.

The hypochlorite treatment has its limitations, of course. It can not be considered as a substitute for filtration, for, in the quantities ordinarily used, it has no material effect on the chemical or physical qualities of the water. Its value lies wholly in the fact that it destroys pathogenic bacterial life. When used in connection with water filters as a final "polisher," it insures the removal of the last vestige of potential danger which the water may possess after filtration. Though the filtered product, while clear, colorless, and otherwise physically and chemically satisfactory, may at times contain a small number of pathogenic germs, these are quickly and permanently destroyed through the agency of a small amount of hypochlorite applied to the filtered product.

Speaking very broadly, filters thus become water clarifiers, and the hypochlorite treatment is used to insure high bacterial purity coincidentally with the destruction of disease germs. Being used substantially as water clarifiers, the filters may be run more cheaply. Less coagulating chemical is required, since high bacterial efficiency on the part of the filters is not absolutely essential. Where waters are heavily burdened with algae growths, the use of small quantities of hypochlorite will destroy such growths, and make it possible for the filters to run longer between periods of necessary cleaning. Such was the experience at Cincinnati. Finally, the use of hypochlorites in connection with water filters results in a feeling of complete security, and the consumer rests confident that he has been furnished with water, not only satisfactory to the eye and taste, but free at all times from pathogenic germs.

The particular adaptability of the hypochlorite treatment is not only in connection with water filtration plants, as above outlined, but also in the sterilization of waters which are normally clear but which contain pathogenic germs. This refers to lake waters, as distinguished from turbid river waters, to clear-water brooks flowing through inhabited water sheds, and to impounded supplies. It has a field of usefulness in the temporary treatment of turbid and colored waters until such time as permanent filtration works can be built for the removal of this color and turbidity.

As stated before, hypochlorites are obtained in powdered form if hypochlorite of lime, or in liquid form if hypochlorite of soda, the same being produced electrolytically by subjecting solutions of common table salt to the action of an electric current. The powder is more widely used at this time, owing to the fact that it is better understood, and because it is somewhat cheaper, but it is to be pointed out that, with the improved electrolyzers which are now being built, if salt can be obtained for one-third cent per pound and electric current 1½ cents per kilowatt hour, it is probable that the electrically prepared hypochlorite of soda will prove to be as cheap as, if not cheaper than, the hypochlorite of lime in powdered form. With the liquid hypochlorite there is no sludge to be dealt with; but in the case of the hypochlorite of lime a small quantity of sludge, not great to be sure, has to be disposed of at semifrequent intervals. With the liquid hypochlorite there is no offensive dust, and this is a factor of no small importance. Much is to be looked for in the near future as regards the adoption of the electrically prepared hypochlorite of soda, which is quite as efficient (if not more efficient per unit quantity of available chlorine) as hypochlorite of lime.

If nothing more were needed to prove the real value of hypochlorites in water sterilization, the large number of spectacular epidemics of typhoid fever which have been stamped out through the introduction of hypochlorite plants in the last few years would be ample evidence. During the past few years such epidemics have been promptly and economically stopped in many cities in this country, among which may be mentioned Des Moines, Iowa; Erie, Pa.; Kansas City, Mo.; Milwaukee, Wis.; Minneapolis, Minn.; Montreal, Quebec; Omaha, Nebr.; Strathcona, Alberta; Toronto, Ontario; and Trenton, N. J.

WEDNESDAY MORNING, SEPTEMBER 25, 1912.

SEWAGE DISPOSAL BY OXIDATION METHODS.

John Duncan Watson, M. Inst. C. E., Birmingham, England.

In using the words "sewage disposal" sanitary engineers have in their minds more than the mere conveyance of an objectionable liquid beyond the reach of the masses, and when they speak of "purification of sewage" they think of something less than a complete elimination of those substances from potable water, which when added to it give the liquid the designation of sewage. Complete elimination is prohibitive, inasmuch as it is beyond the limits of a reasonable demand on the public purse. The word "purification," as it is employed in this paper, should therefore be understood in this restricted sense.

There must, of course, be some standard to guide the designer of a sewage purification plant, but what that something should be it is difficult to say. It is not difficult, however, to say that it should not be 0.1 part per 100,000 albuminoid ammonia and 1 part per 100,000 oxygen absorbed, as in Lancashire and Yorkshire. A standard should be more or less of a mutable quantity, high where the river into which the effluent to be discharged is pure, and not so high where the river is impure and of great volume.

On the whole, the condition of the river below the point where the effluent joins it is a safe guide, and should be the ruling factor in determining the degree of purification desirable. I suggest that the designer of the plant should aim at producing:

(1) A sewage effluent that will not putrefy on being kept for seven days at a uniform temperature of 80° F.;

(2) That it should be the result of natural processes;

(3) That it should not contain more than 3 parts per 100,000 of suspended solid matter; and

(4) That it should not absorb oxygen from the stream into which it flows.

In purifying sewage by oxidizing methods, it is essential first to separate the solid from the liquid impurities, not because it is impossible without nuisance to purify crude sewage on oxidizing beds, but because such a course is far from economical. The sludge question is to be introduced by Dr. Imhoff. It is therefore unnecessary to discuss it here beyond emphasizing its importance in every scheme of purification. The success of every oxidizing process is more or less dependent upon the efficiency of the methods adopted to eliminate solids; the most perfect design of oxidizing filters may be rendered abortive if the sewage is not suitably prepared before it is applied to the surface of the medium. The evolution of the Emscher tank has given a fillip to the consideration of the sludge question which will bring us nearer the solution of the sludge problem. Care should be taken, however, not to clothe the tank with virtues which it does not pretend to possess. It has been designed to retain and digest solids, and render them at once inoffensive and capable of being readily dried at moderate cost, and I can bear testimony to its ability to do all this, but it does not follow that the Emscher tank will be a suitable medium by itself for preparing sewage for the bacteria bed. It does not take the place of the settling tank, whose function is to equalize the quality of sewage arriving at the outfall works, nor does it pretend to eliminate colloidal or ferruginous matter which, if run onto a filter in excessive quantity, would certainly impair its usefulness.

The tank, however, has succeeded in keeping sewage from fermenting when that course is desirable, while the solid organic matter is at the same time resolved by the septic process into an inodorous and easily dried substance incapable of giving rise to nuisance. I tried hard to make this stride in 1901, but failed, after an effort extending over the whole year. In a paper read, in 1906, at the Annual Conference of the Institution of Municipal and County Engineers, I stated that the irreducible residuum of the septic process was an inodorous substance which had been used at Birmingham since 1903 to fill up land depressions in the neighborhood of the septic tanks. Thanks to the excellent work of Dr. Travis and Dr. Imhoff, this work has been still further developed.

When the sewage has been properly prepared by settlement, chemical precipitation, septic action, or a combination of them all, it should be exposed to the action of the friendly microbe, and, if that action is sufficiently prolonged, the constituent matters of the sewage, such as albumen, are practically destroyed, or, more correctly, converted into carbonic acid, free ammonia, and nitrates. When everythink is taken into account, I believe it will be found that this can best be done on what are termed percolating filters, but contact beds are also capable of doing somewhat similar work, and if the production of a consistently good effluent were the only desideratum, land irrigation, and intermittent filtration, which is a form of the same thing, are capable of doing even better work.

One of the reasons assigned for the appointment of the Iddesleigh Commission, in 1898, was the difficulty of obtaining suitable land in England for sewage purification. As everyone knows, the interim report issued by the commission in 1903 stated that it is practicable to produce, by artificial processes alone, effluents which will not putrefy, and may be discharged into a stream without creating a nuisance.

At no time has the efficiency of good land as a vehicle for sewage purification been impugned. When land has been found to be unsuitable in quality, inadequate in area, or too dear in price, it has been condemned. A notable instance of this is to be found at Birmingham, where the District Drainage Board acquired 5 or 6 miles of the valley of the Tame at a cost of £400,000. Much of this land was unsuitable in quality, and the constant increase of population rendered it necessary to adopt other methods of purification, but so far this is the only example of a great sewage farm having been abandoned in favor of a biological purification plant. There appears to be a prospect of Paris following the same course. A paragraph on page 92, volume 2, of the report of Dr. Calmette and four colleagues to the Minister of Public Instruction, after describing what Birmingham has done, says, "This is exactly the solution which we are convinced will be forced on the City of Paris."

Some years ago a well-known English expert, in speaking of the relative merits of percolation and contact beds, stated that contact beds were dead. His remark was somewhat premature, as Sheffield has since laid down 40 acres of those beds; at the same time, he voiced an opinion which is being strengthened daily, and it may now be assumed that percolation beds are being constructed in England in preference to contact beds, wherever the conditions are suitable. A notable case to the contrary is Oldbury, where, after a series of experiments extending over a considerable time, Professor Frankland and Mr. Silvester came to the conclusion that triple contact beds were more suitable than percolating beds for the purification of a sewage containing large quantities of acid of which sulphocyanide formed a prominent feature.

In their fifth report the Royal Commission states that, taking into account the gradual loss of capacity of contact beds, a cubic yard of material arranged in the form of a percolating filter will generally treat satisfactorily nearly twice as much tank liquor as a cubic yard of material in a contact bed. Percolation filters are better adapted to variations of flow than contact beds. The effluents from them are usually much better aerated than the effluents from contact beds, and, apart from suspended solids, are of a more uniform character. The risk of nuisance from smell is greater from percolating beds than from contact beds. The Commission also found that with percolating filters there is nuisance from flies. No one has attempted to upset the dictum of the commission, and where contact beds are adopted in future there will probably be found to exist special local and physical reasons for their preference.

The cardinal principle which has always influenced me in preferring percolation beds to contact beds is the belief that the oxidizing process is dependent upon the free admission of air into the heart of a bed. It is obvious that the air supplied to this form of purifying agency is restricted to the volume of sewage treated, whereas it may be equal to many times that volume in a well-constructed percolation filter.

That we have succeeded in constructing the best possible filter should not be taken for granted, lest progress be unduly fettered, but, whatever advance the future may bring with it, the percolation bed as we now know it is not likely to be improved out of recognition.

A brief description of the percolating filter most recently constructed on the Birmingham works may be taken as an indication of what I consider an oxidizing bed should be for the treatment of strong sewage. The filter area referred to is 6.6 acres, and it is nearly equally divided into two portions. The floor is laid with concrete, 4 inches thick, on a foundation inclined at a gradient of 1 in 100 toward the effluent channels. The concrete floor is covered with semicircular aerating tiles. These are carried through the inclosing walls, so that the air may pass without hindrance from side to side of the bed. The inclosing walls are 5 feet in height, and are built of rubble stone (Croft granite) laid without mortar. The thickness of the base is 2 feet 6 inches, battering 5 to 1 on the outside face, and where the walls are built transversely to the lines of aerating tiles the latter are carefully bedded and levelled on top with cement mortar to form a foundation for the wall. The top course is levelled up with stone bedded in cement mortar. The medium, which has an effective depth of 6 feet, consists of hard stone or ball slag of best quality, broken as uniformly as possible to pass a 2-inch ring and be rejected by a 1-inch ring. The main supply pipe, 21 inches in diameter, is laid alongside the eastern walls of the block, from which branch pipes, 10 inches in diameter, are led to the beds and extended to the opposite side, where they are connected up to the washout pipe. These branch pipes are laid across the beds in parallel lines, and at right angles to them 3-inch distributing pipes are laid, in which spray jets are inserted. The pipes are made of cast iron and weigh 6½ pounds per foot; the thickness is not more than three-sixteenths inch, since the maximum head is only 10 or 12 feet. They are laid on the bacteria bed without special support, but Jones's expansion joints have been employed to couple them together.

The actual cost of constructing block D, exclusive of any work or pipe connections beyond 3 feet outside the walls, is as follows:

Excavation	£1,100
Concrete floor	2,250
Collecting channels	200
Tile floor	4,500
Rubble walls	850
Medium	19,860
Distributing pipes	1,650
Valves	175
Total	30,585

On a net area of 6.6 acres this is equivalent to £4,620 per acre.

The filters first constructed at Birmingham cost £6,300 per acre, owing chiefly to the smallness of the unit area; as, however, each advance in size gave an equally well-oxidized effluent at less cost, the area has increased with the construction of each block of beds, and the latest now under construction is 7 acres. Engineering and economic reasons alone should determine the unit area.

Purification depends on various factors, but mainly upon the extent of bacterial surface—as Mr. Rudolph Hering has called it—over which the tank liquor is made to trickle and the time it occupies in percolating from top to bottom. The question of the size of medium and depth of bed must have a direct bearing upon the volume and strength of liquor to be oxidized.

Theoretically, a fine medium should be preferred to a coarse one. Dr. Reid has studied the virtues of a small medium, and, as the result of his study and experience, has consistently advocated its use. He can point to Hanley and other places where fine medium is used successfully; he can show that there is eight times the bacterial surface available for purification in $\frac{1}{4}$-inch cubes as compared with 2-inch cubes, and he can show consistently good effluents from fine-grain shallow filters. The Dorking experiments confirmed the main points of Dr. Reid's contention. At Birmingham and other places a medium of a large size, approximating to 2-inch cubes, is used.

Since it is admitted that with a fine-grain medium less depth is required and a more brilliant effluent obtained, the question naturally arises, Why not adopt a fine medium? Chiefly because a large medium of greater depth to do the same work is not more costly and it provides greater security against pooling and clogging.

In large manufacturing districts sewage varies in composition, and an engineer, in designing a purification plant, should see that it is capable of giving that elasticity which is invariably demanded from purification plants in exceptional weather and when unexpected rushes of trade waste arrive at the works.

The designer of oxidizing beds should not rely upon the infallibility of preliminary tank processes to free the filters of all unnecessary work. Mistakes take place in management, the composition of the sewage may permanently alter, and the colloids permanently increase, as at Manchester, where the albuminoid ammonia figure has in recent years gone up nearly 100 per cent. A town's manufactures may change entirely, as at Coventry, where silks and watches have given place to the motor industry. Aeration is often impaired by unfavorable climatic conditions, as, for instance, at Birmingham, where, when unsepticized sewage was applied to the bacteria beds in cold weather, it was found that the surface rapidly became "mackintoshed" over with a thick gelatinous fungoid growth. No doubt this is a condition capable of prevention, but the designer of the works may have no control over the management, and should see that a sufficient margin of safety is secured by constructing a filter which readily recuperates, otherwise the design is unjustly blamed.

Anxiety on the part of public bodies to keep down initial expense in constructing bacteria beds should be met firmly and, if possible, with figures to prove that cheap beds are not profitable. A medical friend, who holds a distinguished public position, once complimented me on the appearance of the massive masonry walls round the Minworth bacteria beds, but proceeded to question whether the expense was justifiable, and added that a medium should be allowed to slope on a natural angle from the top of the bed. He was astonished when I gave him figures to show that his untidy method would cost double what the massive walls had cost. Later, he suggested that the nitrifying organism would do as good work on a heap of unscreened clinker as on a well-prepared oxidizing bed, and he pointed to a case where beds had cost less than £2,000 per acre. I hold him that I had constructed several acres of beds in this way at a cost of only £800 per acre. I was not able then, but I can now give the cost of treating 1,000.000 gallons of sewage on those "cheap" beds, compared with the cost of treatment on the beds already described:

	Slag and granite.			Furnace ashes.		
Volume, in million gallons	1,741			308		
	£	s.	d.	£	s.	d.
Capital cost per acre	[a] 7,100	0	0	800	0	0
Interest on capital cost at 5.6 per cent per million gallons	1	10	3		18	11
Working cost per million gallons	1	4	0		9	9
Total cost per million gallons	1	11	7	1	8	8

[a] This figure includes a proportionate share of the cost of supply and effluent channels, silt and separating tanks, railway, wharf, etc.

The initial cost of the "dumped" furnace ashes bed, it will be observed, is low, and the maintenance charges high, as compared with the carefully constructed stone and slag bed. The furnace ashes bed—as might be expected from 6 feet of fine medium—produced a very good effluent, but the surface, being dosed with strong Birmingham sewage, clogs readily. Washing and replacing are not attemped, as this work would amount to 1s. 6d. per yard, or much more than new material would cost. Periodical scraping and removing of the top layer is found to be sufficient.

It is urged against a large medium that another process is necessary to separate the humus from the filtrate before it is fit to enter a river, but as this can be done in separating tanks for 2 shillings per million gallons the objection is of comparatively small moment.

A fine medium bed had advantages where a brilliant effluent is a desideratum, where it would be difficult to get rid of humus from the filtrate, where a high cost for maintenance is not prohibitive, and where a temporary stoppage of the whole plant would not be a very serious matter, but it is not suitable for installations of any magnitude.

Unless the upper layers of a percolating bed consist of a very fine medium, as in Dr. Dunbar's filter, at Harzburg, the sewage, in its passage through a healthy filter, emerges at the bottom immediately under where it drops upon the surface. The establishment of this fact emphasizes the desirability of feeding a percolating bed in such a way that each particle of material receives an equal quantity of liquor.

Engineers have had varying success in their efforts to design appliances capable of fulfilling this important condition. Some excellent devices have been brought to the notice of the public by their makers, and a good deal might be said in favor of each, but the best are costly, and the worst are cheap only in name. It may be assumed that moving distributors are all liable to be prejudicially affected by wind, frost, and snow, unless they are power driven, in which case they are more costly. On the other hand, wind, as it influences the spray jet, and it is rarely perfectly calm in this changeable climate of ours, tends to equalize the distribution, when this type is used.

Absolute uniformity of distribution there can not well be. Even the Scott-Moncrieff distributor, the most uniform distributor I have known, which rotated round bed C at Minworth with all the regularity that an electric drive could give, dropping as it travelled sewage so equal in volume that test trays 12 inches square placed close together in a straight line from center to circumference resulted in collecting the same quantity in each tray, was no exception to this rule. Now compare the results of six months' working of this distributor with similar work by spray jets on adjacent beds dealing with the same tank liquor, and after both beds had been at work for about two years:

		Scott-Moncrieff distributor.	Spray jets.
Volume treated during 6 months	gallons	29,500,000	72,000,000
Rate per square yard per day whilst working	do	154.6	169.3
		£ s. d.	£ s. d.
Capital cost of beds per acre, including all subsidiary works		11,148 0 0	7,170 0 0
Interest on capital cost	per million gallons	2 6 10	1 4 7
Working cost	do	12 2	12 10
Total cost	do	2 19 0	1 17 5
		Parts per 100,000.	
Oxygen absorbed in 4 hours, filtrate		2.784	3.018
Oxygen absorbed in 4 hours, separating tank effluent		2.041	
Percentage of purification, filtrate		84.3	83.0
Percentage of purification, separating tank effluent		88.5	
Albuminoid ammonia, filtrate		.274	.370
Albuminoid ammonia, separating tank effluent		.239	
Percentage of purification, filtrate		78.6	71.1
Percentage of purification, separating tank effluent		81.4	
Nitrates and nitrites as nitrogen		2.208	2.089
Suspended solids, filtrate		4.9	8.8
Suspended solids, separating tank effluent		1.7	

When it is borne in mind that the Scott-Moncrieff distributor rotated on a bed 7 feet deep and that the spray jets were fixed on a bed only 6 feet deep, the resultant effluents do not appear to justify the conclusion that the one is much better than the other. My contention is that the total effluent must necessarily be compounded of volumes which have undergone varying degrees of purification on different parts of a filter. If, for mechanical or meteorological reasons, the spray is not distributed uniformly, certain portions of the filter get more work to do than others, but this is got over to a large extent by changing the position of the jets periodically, and, of course, change in the direction of the wind automatically brings about constant minor changes, which tend to even up the distribution. So long as these conditions obtain, and water logging is avoided, the practical result is not unsatisfactory. Nor should it be forgotten that, even though the intermittency is irregular, that part of the bed which for the time receives no sewage may be recuperating and adjusting itself to bear a strain later on. Assuming for a moment the worst possible case—namely, that a certain portion of the filter never received any sewage—the effect would be that a larger volume of filtering material would be required to achieve the same result, and thus the true engineering aspect of the matter appeared—that is, the question whether it was better economically to spend money on extra filtering material, or on extravagant methods of obtaining ideal distribution. This could be decided only by considering the total resulting purification of a given volume of sewage in terms of the total cost of obtaining it, and not merely the cost of the distributing mechanism.

All forms of distribution on percolating filters are liable, if a strongly smelling liquor has to be dealt with, to give rise to nuisance from smell. In the case of trays or tipping troughs, the smell is more or less confined to the immediate vicinity of the filter, and it may largely be done away with at small works by providing an inexpensive form of cover for the filter. The spray jet has been held to be the most liable to give rise to smell, but moving sprinklers are almost equally bad in this respect. This is bound to be more apparent during periods of prolonged heat, but the application of hypochlorite of sodium, as used at Ostend, in Belgium, or of hypochlorite of calcium, as used at Birmingham, Hanley, Burslem, and Stratford-upon-Avon, although costly, is fairly effective when mixed with the tank liquor before its application to the oxidizing filters. Care should be taken not to apply as much as will inhibit the life of the nitrifying organisms, or produce injury to the river into which the effluent enters. If it is applied before septic action is too far advanced, 1 part per 100,000 will probably be found to be sufficient, and this quantity will be more than enough to keep down the fly nuisance.

One word with regard to management. However well a plant may be designed, if it is not well and skillfully managed it will become a nuisance and bring discredit on the engineer who designed it. The disposal of the liquid filth of a great community has an enormous potentiality for evil, and if town authorities believe it necessary to avert this by expending large sums of money on constructional work, it is their bounden duty to see that the plant is placed in the most competent hands. Local authorities are by no means sufficiently alive to this aspect of the question, with the result that too many works are left to the management of untrained men. Hitherto anybody has been deemed good enough to look after a sewage work, but the day has now come when the manager should be a highly trained technical expert if local authorities hope to get full value out of the sensitive entity which we call a bacteria bed.

SEWAGE DISPOSAL BY OXIDATION METHODS.

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The scientific solution of the sewage problem will not be attained until the following results can be guaranteed for any given case:

1. An effluent which will not deteriorate the stream into which it flows.
2. No nuisance in the course of sludge disposal.
3. No nuisance from smell or from flies in connection with the filter beds.

4. An expenditure strictly proportionate to the sanitary and esthetic results achieved.

Those of widest experience will be the least ready to say that these criteria of success are at all commonly fulfilled.

It may not be uninstructive briefly to consider these four directions of effort, with the object of seeing what has been satisfactorily accomplished, and what yet remains to be done:

1. *Effluents.*—The success of a works is most frequently judged entirely by the effluent produced, generally in accordance with some more or less recognized standard of purity.

The question of standards is too large a one to enter upon here, more especially as the Royal Commission on Sewage Disposal is shortly expected to issue a report upon the subject.

Taking a broad view it is probable that the criterion of purity suggested above, namely, an effluent which will not deteriorate the stream into which it flows, is a comprehensive and practical one.

It allows for some advantage to be taken of dilution, if the volume of the stream be large in proportion to the volume of the effluent; it insures an automatic speeding up of authorities downstream, as those in the higher reaches, who have the initial advantage of clean water, do their duty; it is, in fact, in accordance with the judgment in the recent famous Birmingham *v.* Tamworth case.

The principle of judging an effluent by its effect in the stream into which it flows has many advantages. It is exceedingly difficult to obtain a true average sample of the effluent from any sewage works. Conditions vary from day to day and, indeed, from hour to hour. Land areas may have been recently plowed, and the effluent for an hour or two may be distinctly unsatisfactory. A sudden storm may push strong tank effluent through filters at a rate too great for efficient purification, or over the storm overflows without any treatment. Unless systematic sampling at short intervals is undertaken, either as part of the work of the staff, or by means of mechanical devices, many of these incidents will escape notice. Snap samples often give, on the other hand, either too good or too bad an impression of the character of the effluent.

But the character of the stream below the outfall is a permanent and, on the whole, a fair witness. Where gross obvious pollution is not in evidence, a body of knowledge is being obtained of the various forms of life which indicate good or insufficient purification. It is astonishing how a small amount of unbroken-down organic matter in an otherwise well-mineralized effluent will encourage the growth of masses of fungus.

The idea of the fish pond as an extra line of defense before the final discharge of an effluent into a stream, which has been successfully applied at many places in Bavaria under the direction of Prof. Hofer, is well worthy of careful study.

A consideration of the effect of an effluent on the forms of life and growth in a stream leads to the important question of disinfection, a subject which has recently been so ably dealt with by Prof. Phelps.

There is one point which, in the writer's opinion, has not been sufficiently studied in this connection, namely, the possible effect of sterilizing agents on the microflora and fauna of the stream, other than bacteria. A comparatively small dose of chloride of lime will inhibit fungus growth, just as a small dose of copper will prevent the development of algæ. It is worthy of further study whether the addition of chloride of lime to an effluent, in sufficient amount reasonably to protect a water supply, may not at the same time upset the balance of life on which the continued healthy condition of a stream depends. Speaking generally it may, however, be said that, of the four problems referred to, the problem of the effluent has been carried furthest to a scientific solution.

2. The sludge problem is really the center of the general sewage problem. The method of handling the solid matter, which in some form or other has to be separated from sewage, conditions the size and character of the filters, and the main question in the design of sewage works lies broadly in the allocation of expenditure as between sludge disposal and filtration costs. Thus very perfect clarification of sewage by heavy doses of chemical renders possible great economy in filter construction and maintenance, while with adequate filter area it is possible practically to dispense with preliminary treatment altogether. How far expenditure is best incurred in one direction or another depends entirely on circumstances, and it is here that judgment and experience are called for.

The Fifth Report of the Royal Commission on Sewage Disposal was by no means unfavorable to chemical treatment in a number of cases. It may be doubted whether the dilute sewages resulting from the lavish use of water in American cities lend themselves generally to economical precipitation by chemicals.

The writer has had occasion lately to go somewhat deeply into the question of precipitation of sewage, and has concluded that chemical treatment is to be recommended where the following conditions predominate:

(*a*) Where sludge disposal is cheap; (*b*) where land for filters is restricted; (*c*) where filter construction is expensive; (*d*) where fall is limited for either coarse percolating filters or double contact beds; (*e*) where special trade refuse has to be dealt with.

Conditions (*a*) and (*b*) probably both apply in Glasgow, and to a less extent in Salford. Condition (*c*) depends largely on facilities of transport, which vary within wide limits. Condition (*d*) obtains, e. g., at Hanley and elsewhere in the "potteries," and shallow percolating filters of fine material are employed. It is thought by some that with small material clogging takes place unless precipitants are used, but Dr. Reid and others dispute this. Chemical precipitation is, as a matter of fact, achieved at Hanley by means of the "slip" or fine clay from the pottery works, which comes down with the sewage. Ordinary septic-tank treatment is likely to be disastrous for such filters, causing rapid blocking. Condition (*e*) is exemplified at Wakefield, where, owing to the presence of wool-scouring liquors and other troublesome trade effluents, chemical treatment by lime and ferric sulphate has been adopted under the advice of the writer.

Of course, the main difficulty with chemical treatment is the disposal of the resulting sludge. Apart from its quantity, the fact that it contains a large proportion of precipitated soaps renders it unsuitable for use as a fertilizer, as it is not readily incorporated by the soil.

Should Dr. Grossmann's grease-extraction process, now being tried on a large scale at Oldham, or the partial carbonization process, now being taken up by Norwich and Huddersfield, prove successful, even to the extent of disposing of the sludge in a satisfactory manner without additional cost, chemical precipitation may have a more extended use than was at one time thought likely.

The use of the septic tank as a solution of the sludge problem has not proved altogether the success that was at one time hoped, but here as always in considering the sewage problem it is important that conclusions should not be too hastily drawn.

The defects which have shown themselves in the ordinary septic-tank process are nuisance both from the tank effluent and the sludge, and an excessive quantity of suspended solids in the tank effluent.

The Emscher tank, concerning which much has been written of late, seeks to remedy these defects by quickly separating the sludge and the effluent. The liquid portion of the sewage passes quickly through the tank in a fresh state, while the suspended solids drop through a slot into a lower compartment, where the sludge is thoroughly digested under anaerobic conditions, the construction of the tank preventing any fouling of the effluent through escaping gases and suspended matters.

The tank certainly appears to be successful in eliminating nuisance both from sludge and effluent, and, under certain conditions, has manifest advantages. The Manchester Rivers Committee has recently decided to install a trial Emscher tank at the Withington sewage works, where the sewage is dilute and purely domestic, and the present tank space inadequate, especially in rainy weather.

Nevertheless, it is well that certain difficulties inherent in the Emscher tank process should be pointed out.

In the first place, the comparatively short time of settlement means that variations in the character of the sewage must be quickly reflected in the character of the tank effluent, and that the filters must be called upon rapidly to accommodate themselves to fluctuating conditions. This is not conducive to the development of the most efficient bacterial activity. These fluctuations will of course be accentuated when trade wastes are present in the sewage. One of the main advantages of the considerable time allowed for the sewage of Manchester to pass through the tanks at Davyhulme is that fluctuations of this sort get smoothed out, to a large extent, at any rate, and that the filters have a more equable task to perform. In some cases large tank space may be a bulwark against possible disaster, as when on a recent occasion an acid chamber gave way at a works in the city, letting out many tons of vitriol into the sewage. The strong acidity of the sewage entering the tanks was, however, nearly neutralized by the mixing with the slightly fermented sewage present in the tanks, and the filters incurred no noticeable damage.

It appears to be recognized by the Emscher authorities that storm water, above moderate dilutions, will have to receive separate treatment, and that ordinary stand-by tanks will still be necessary for this purpose, the sludge from which will have to be dealt with.

In any event, the suspended matters which produce the sludge in the Emscher tanks are those which settle readily, say in the space of two hours. The colloids, such as are eliminated by chemical treatment, have still to be reckoned with, and the character and extent of the filter beds designed accordingly. In many cases, this may mean that fine material can not be used for constructing the filters, and the alternative adopted of deep filters of coarse material, with the possible resultant nuisance from flies, to be referred to later.

A third consideration with reference to the Emscher tank has been forced upon the writer's attention through a small experiment in connection with the sewage of a public institution, where it has been possible to test, side by side, a small Emscher tank and an ordinary septic tank.

Here the sewage was very strong and, what is even more important, very fresh. In consequence, although an effluent free from visible solids and also from putrid odors was obtained from the Emscher tank, on analysis it was found to be less broken down than the effluent from the septic tank and less readily oxidized by the subsequent filtration process.

In the controversy between the advocates of anaerobic or aerobic methods of treatment, the essential biological and chemical reactions which must take place before nitrogenous organic matter is finally mineralized, particularly the dilution of the sewage and its alteration during its passage through long lengths of sewer, are often lost sight of by reason of incidental circumstances. When strong, fresh sewage has to be dealt with, empirical conclusions drawn from ordinary town sewage cease to hold good.

This is especially so with the strong sewages often met with in tropical regions, where high temperature may coincide with restricted water supply.

The writer's researches in latrine sewage in Calcutta, in 1906, showed that preliminary anaerobic treatment in properly designed tanks gave better results than purely aerobic methods, and this conclusion has recently been confirmed by careful detailed experiments by Maj. Clemesha, sanitary commissioner for Bengal.

These researches showed that the bulk of the suspended matter was best broken down in a separate inlet compartment to the tank, but that distinctly better results were obtained, the longer time the whole body of sewage took to pass through the tank, up to a maximum of three days.

All these considerations would tend to show that, if the best results are to be obtained, the Emscher tank may need to be supplemented by some form of equalizing tank.

Some of the difficulties above indicated attach themselves to the Dibdin slate bed. The true function of this process does not seem to be very generally understood. The slate bed is not a filter in the sense of a percolating filter or contact bed, but rather an aerobic tank. The coarser suspended matters in the sewage deposit themselves, during about two hours' period of contact, on the surfaces offered by the slates and are afterwards digested by multifarious forms of life flourishing under aerobic conditions. The effluent from the slate bed should be treated as a tank effluent and filter space provided, in the usual way, according to its strength. In order that the filters may work to the best advantage, it is probable that the provision of "humus" tanks between the slate beds and the filters is desirable. Such tanks will have the double advantage of retaining solids washed away from the slate beds, and of equalizing to some extent the composition of the effluent passing into the filters. They have, the writer has heard, been adopted in a recent scheme for Harpenden.

The slate-bed process has undoubtedly been successful in many cases in dealing, without nuisance, with the sludge-disposal portion of the sewage problem. When compared with continuous-flow tanks, where the loss of fall involved is trifling, the process is somewhat handicapped by cost and by the fall needed for the slate bed as a preliminary process.

3. The foregoing section will have indicated that the character of filter to be recommended, whether contact bed, coarse percolating filter, or fine percolating filter, must depend to a great extent on the preliminary treatment used.

There are certain sewages where almost any kind of tank treatment is bound to result in nuisance. Especially is this the case where brewery refuse is present in the sewage in any large proportion. Considerable trouble from this cause has been experienced at Stratford-on-Avon, and treatment with lime and bleaching powder has had to be resorted to in warm weather in order to minimize the smell. At Burton, after heavy treatment with lime, the sewage is pumped directly onto land.

In such cases either the slate-bed method or direct treatment on filters of the Ducat type would seem to be called for.

Successful trials of the use of a layer of peat over the material of an ordinary percolating filter have been made under Dr. Dunbar at the sewage experimental station at Hamburg.

The writer is at present experimenting with this method in connection with the disposal of the sewage of Market Drayton, which is particularly strong and offensive. At the adjoining parish of Little Drayton a Ducat filter has been in successful operation for many years, and has been reported upon by the Royal Commission.

The type of filter apparently most in favor in America, and also to a less degree in England and in Germany, is the deep percolating filter of coarse material. It admits of the passage of large quantities of sewage without blocking, and eventually discharges, as so-called "humus," a considerable proportion of the colloidal matter applied to it. Consequently it is, for practical purposes, everlasting. Filters of this type have been at work successfully at Accrington since 1898, or for 14 years. Unfortunately, the spraying of anything but fresh tank effluent on these filters is attended with considerable nuisance from smell, and whether the tank effluent be fresh or septic the development of insect life, particularly flies and spiders, is often extraordinary. Instances could be cited of spray jets completely blocked with twisted spider webs; of ropes of web, like scarfs, from filter to filter; of small flies nearly covering the doorway of a cottage half a mile from the works, and so forth.

However good the effluent from such filters, and however economical their construction and maintenance, it can not be said that such a process meets all sanitary and esthetic requirements.

Experience shows that if the surface layer of the filters is of fine material the fly trouble is minimized, and this was one of the reasons for adopting a fine surface layer in the new filters at present under construction at Wakefield. Of course, such a fine layer presupposes good preliminary clarification, or a somewhat restricted flow; and, again, the balance of advantage has to be considered.

There can be no doubt that the main advantage of the contact bed lies in its freedom from nuisance.

There have been no complaints nor causes for complaint in connection with the 100 acres now in operation at Davyhulme, or with the 40 acres or so now installed at Sheffield. The cost of maintenance of these beds has not been excessive, even with a thorough washing and partial renewal of the medium every five years.

Incidentally it may be mentioned that the "slurry" washed out from the filtering medium, after pressing with lime, drying, and grinding, finds a ready and profitable sale for direct use as a fertilizer of moderate strength, or as a basis for the manufacture of high-strength fertilizer.

4. The economical and the scientific solutions of the sewage problem are really coincident, and the more the two ends are borne in mind the more quickly will the desired goal be reached.

It is still possible to see costly devices installed at sewage works, when a little careful scientific investigation and thought would have shown that they could never achieve results proportionate to the outlay. Apart from actual analysis and measurement, it is easy to draw the conclusions that a special form of mechanical filter is removing large quantities of suspended matter, when really either very little has been retained in proportion to the volume of liquid passing or the volume of liquid passing is much less than is assumed.

The cost of certain mechanical distributors, including repairs and loss of lime, in proportion to the quantities actually filtered over lengthened periods, was ably dealt with some years ago by Mr. Watson.

The question of the desirability or otherwise of providing costly sewerage and sewage-disposal works in country districts, where it is of the first importance to spend money to the best advantage, especially in the provision of cheap houses, may well receive the careful joint consideration of the medical officer and the sanitary engineer.

In many towns in India, for example, it is at present financially impracticable to undertake fully developed Western sewerage schemes. Provisional methods, with due reference to possible complete schemes in the future, have in consequence to be devised. Development on such lines may be wisest for many country villages or undeveloped towns.

The harmless return of excreta to the soil is subject, of course, to scientific principles, just as the more elaborate methods of the modern sewage works, and it is well that interest in the latter should not entirely divert attention from the study of more primitive but still frequently necessary methods.

There is need for careful investigation of the rate of change of suspended and colloidal matter in sewage under different conditions.

Closely connected with this question is the large field of research into the conditions of life of the various organisms in sewage works and their relation to the sewage purification process and to each other.

Thus it will be seen that, while in a limited sense it may be stated that the sewage problem is solved, in that the general principles according to which offensive organic matter can be mineralized are now fairly well known, their detailed application will for many years to come afford work for the engineer and biological chemist.

It is gratifying to note that, particularly in America, the value of scientific research on this large problem has always been fully recognized, and that it is now the custom for any scheme of magnitude to be prefaced by preliminary scientific studies. The intelligent cooperation of the engineer and the biological chemist in this work is certain to justify itself by advancing each case nearer to the goal of perfection.

SEWAGE DISPOSAL BY OXIDATION METHODS.

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By disposal of sewage by oxidation methods is meant the exposure of sewage to intimate contact with oxygen and aerobic bacteria. The methods are many, and range from mixing with water containing oxygen to filtration at a slow rate through fine sand. Among these methods are dilution, broad irrigation, and filtration through contact, trickling, or intermittent sand filters.

Few situations allow the use of any of these methods without some form of preliminary treatment, because the disposal of the suspended matter in sewage by oxidation is very difficult, while the treatment of the liquid portions is comparatively easy. This being true, it is strange that so much attention has been given to the final processes rather than to the preliminary steps to prepare the sewage for them. Even for disposal by dilution some preliminary screening of sewage is desirable; otherwise, banks of suspended matter, that is, sludge, accumulate in the water courses, while unsightly floating fecal matter and débris offend the senses. Furthermore, it is necessary that sewage applied to trickling filters be clarified, lest the nozzles and other distributing apparatus require too frequent cleaning. The pretreatment of sewage applied to contact filters brings about a distinct gain in the efficiency and economy of operation and prevents many of the difficulties due to the clogging of the sand filters, while pretreatment of sewage applied to sand beds makes a higher rate of filtration practicable.

It is evident, therefore, that it is impossible to consider methods of disposal by oxidation without taking into consideration the character of the applied sewage. For example, in Massachusetts good results are obtained where crude sewage is applied to sand beds at an average rate of about 50,000 gallons per acre per diem, but, if the sewage be screened or settled, or both, the rate may be increased to from 100,000 to 200,000 gallons per acre.

In recent years the screening of sewage by means of fine screens, as a supplement to the ordinary coarse screening by gratings, has been very extensively practiced abroad, and so much has been claimed for the results obtained that the practice has extended to this country. The chief examples are at Reading, Pa., Brockton, Mass., and Atlanta, Ga.

At Reading the sewage is first subjected to plain subsidence and later disposed of on trickling filters. Before the introduction of screens the cost of cleaning the sprinklers was excessive and the large amount of suspended matter removed from the subsiding basins imposed a great burden upon the operation of the works. The results of screening have been satisfactory, but the mechanical details of the plant need further improvement to reduce the cost.

At Brockton a similar screen has been in operation for less than a year. This screen receives the sewage from the collecting well and discharges it through a long force main on sand beds. Previously the matter settling out in this well was pumped periodically to special sludge beds. At present the screen is removing about 30 per cent of the suspended solids.

The screenings are discharged into bags and the latter are whirled in a centrifugal machine until the screenings are dried. They are disposed of in the neighborhood of the pumping station by placing in a layer 3 feet deep and covering with about a 6-inch depth of earth. The future problems in connection with this screenings-disposal field have not yet been worked out. Naturally highly putrescible organic matter buried in earth with insufficient access of air must undergo putrefaction and very slow decomposition, and it is only a matter of time when the question of sufficient area to dispose of the screenings in an inoffensive manner will become a problem. Unless kept completely covered, the deposits give rise to offensive odors. Incineration is possible, however.

It seems unwise to the writer to attempt to dispose separately of two kinds of sludge, namely, that removed before and that remaining after subsidence. If all of the coarse suspended matter be digested in a tank of the Emscher type, it can be disposed of upon ordinary open sludge beds, and the necessity of covering to prevent nuisance may be avoided. On the other hand, the screening of the effluent from a settling tank, in order to reduce the operative charges for the cleaning of sprinklers, is an economical practice. Furthermore, the actual amount of material screened from basin effluent is small in comparison with that removed from the unsettled sewage, and its subsequent disposal is not a serious burden.

Another method of preparing sewage for oxidation is by means of plain subsidence. This is most necessary. Even if crude sewage be discharged into bodies of natural water which may flow with considerable velocity, there is a tendency to form offensive deposits of sludge, while the discharge of the same upon fine sand beds necessitates excessive costs for cleaning their surfaces. Other things being equal, the amount of material which may be removed by subsidence is a function of the velocity of flow through the tank, and under ordinary circumstances it is not practicable to remove more than 50 per cent of the suspended matter by this method alone. The matter so removed, however, consists of those particles which most interfere with the operation of final methods of treatment.

Therefore, regardless of the method by which the sludge is disposed, the subsiding basin is an economical preliminary to any process for the disposal of sewage by oxidation.

Of the methods for disposal mentioned above, dilution is used by far the most frequently in the United States for the simple reason that most of our large cities are located upon tidal waters or large streams. In many of these waters conditions have already become such that this method can no longer be practiced without nuisance. Notable examples of this are the cities on the lower Merrimac, the city of Philadelphia, and the Moon Island outlet of the Boston system. Similar conditions obtain in New York Harbor, where the depletion of the supply of oxygen has been so great that any considerable further addition of sewage would result in a serious nuisance. The remedy is, of course, the discharge of the sewage where the dilution is greater, or the employment of such preliminary treatment as will make inoffensive the discharge at the present point of discharge.

For the disposal of sewage by dilution, not only must the volume of oxygen present be adequate in amount, but the mixture of sewage and water must be intimate, in order to make this amount of oxygen effective. This is a difficult matter unless the outlets be widely separated, for, as a rule, sewage is warmer than water and warmer and lighter than salt or brackish water, so that the physical conditions of each fluid are such that a homogeneous mixture is rarely obtained. In ordinary cases mixtures of sewage and water should be 50 per cent saturated with oxygen. But where there are extensive deposits of sludge, even 70 per cent of saturation may be insufficient.

Disposal by broad irrigation outside of some cities in the arid regions has not been attended with great success in America, the reasons being the high labor cost and the large amount of reserve area which must be at hand, in order to permit the adequate care of the sewage when the requirements for irrigation are at the minimum, notably, after wet periods. Where the sewerage is on the combined system, the minimum capacity and the maximum need occur at the same time. Consequently the use of this method in America is decreasing rather than increasing, and many plants under this name are in reality intermittent sand filters, operating at a low rate, upon which crops are raised. On nearly all, on account of real or fancied danger to the health of purchasers of products, crop raising and sewage treatment are not conducted simultaneously.

There are between 25 and 30 contact filter installations in this country. This does not include many which have been installed for private estates and institutions. It does not seem to the writer that this method has been given the consideration by American engineers that it deserves, notwithstanding the examples of the plant at Mansfield, Ohio, which has been in operation for 12 years, and, on 1 acre of filtering surface, has cared for the sewage of from 15,000 to 18,000 people. The installation at Lakewood, Ohio, is another worthy example of this type; and remarkably good results have been obtained at Plainfield, N. J., although the sewage has been oversepticized before its application to the contact filters.

Between 12 and 15 trickling filters have been installed in this country, and at present among engineers they represent the favorite method. Notable examples of this type of filter are at Columbus, Ohio, Reading, Pa., Atlanta, Ga., and Baltimore, Md. Others are in construction at Fitchburg, Mass., and elsewhere. This type of filter possesses the great advantage of a high rate of filtration and a low cost of operation. The degree of purification, however, which can be effected, is not as great as by the intermittent sand filter, although nonputrescible effluents may be depended upon.

It seems essential, in view of the experience at Columbus, Ohio, that sewage applied to trickling filters shall not be oversepticized, and in this connection the use of a modern subsiding basin, where the process of sludge disposal is separated from that of subsidence, is highly desirable. This permits the anaerobic treatment of the solid portions of the sewage and the aerobic treatment of the liquid. It is believed that for the majority of cases, notwithstanding the experiences of Maj. Clemesha, in India, the aerobic processes are far more economical for the disposal of the dissolved putrescible matter than are the anaerobic. It has been feared by many that without thorough septicization of the liquid portions of the sewage, excessive amounts of colloidal matters would be discharged upon trickling filters; but at present the evidence seems to be in favor of the belief that these matters can be removed more cheaply by contact with coarse material in beds than in any other way. In properly constructed beds of not too fine material, with ample opportunity for flushing out accumulations and liberal provision for the periodical sloughing off of the matter which collects in the interstices of the filter, no difficulty should be experienced because of the presence of colloidal bodies in the applied sewage.

One objection to the use of trickling filters has been the presence of numerous flies. These are of other species than the common *Mus domesticæ*, and so far have not been shown to be the bearers of any infectious disease. It is probably true that flies breed much more rapidly in trickling filters where the preliminary treatment has been inadequate to remove the coarser suspended matter, particularly particles of feces, than where the applied sewage is efficiently settled and screened.

The cost of operation of the trickling filters is much less than that of contact filters, but the latter are free from the fly nuisance.

By far the greater number of plants in the United States are of the intermittent sand-filtration type. They number between 60 and 70, exclusive of those in use at institutions and on estates. The number of these latter must be in the hundreds. Where adequate layers of sand are in situ, and they can be underdrained at small cost, and if properly pretreated sewage be uniformly applied, the system yields excellent effluents at moderate cost. This method has been fathered by the Massachusetts State Board of Health, and, generally speaking, has given excellent satisfaction. It is especially applicable where a high degree of purification is desirable. Where material for the filter beds has to be brought from a distance, the cost of construction may be prohibitive, and, under these circumstances, if the conditions for purification permit, the choice of some other system would seem best.

The problem of distribution of sewage on oxidating beds, whether they be contact filters, sprinkling filters, or intermittent sand filters, is a matter of the greatest importance. During the past three years the writer has been observing the intermittent sand filter plant at Marlboro, Mass., and has seen this plant change from one producing a putrescible effluent, under conditions which gave rise to a suit for damages, to one furnishing a clear, brilliant, highly nitrified effluent of such a character that it could be discharged into almost any stream not used directly for water supply.

The distribution of sewage over trickling filters is also most important, for, in order to employ rates of from one to one and one-half million gallons per acre per day, each portion of the filling material must do its share of work. Several types of nozzles have been designed for the purpose in this country, and when operated in connection with some device for varying the pressure, such as a butterfly valve or an intermittent dosing tank operated by a siphon, the filter operates at its maximum efficiency.

Contact filters, unless operated by hand, depend for their success upon the reliability of the dosing gear. The best types are those which are simplest and have fewest parts to get out of order. There are several such on the market, and it seems that all mechanical requirements for the successful operation of contact filters have been met.

Another important matter is the aeration of septic sewage before application to beds. Frequently, as at Saratoga and in other places, this is accomplished in connection with the operation of the dosing tank. It should not be neglected where the liquid portions of the sewage have putrified to a great degree.

The decision as to which method to adopt in any case is dependent upon two factors: First, the stream or body of water into which the sewage is to be discharged, and, second, upon the character of the sewage itself. In this connection, the writer would give his opinion that the proper place to protect water consumers against disease is at the waterworks and not at the sewage disposal works. Water should be purified and sewage should be disposed of as the stream demands. Ordinarily, this means that the suspended matter be removed, that conditions near the point of discharge be inoffensive, and that the use of the stream for purposes of manufacture and pleasure be not impaired. It usually implies a nonputrescible effluent. Sometimes it means one not only nonputrescible but freed by sterilization from harmful bacteria. In other cases, where the stream is soon after used for water supply, it may mean the discharge of a highly purified effluent like that from sand filters.

In considering the question of putrescibility of the effluent, chemical analysis alone avails but little. The ordinary analytical data, other than those for suspended matter, are not very significant. Of chief importance is the dissolved oxygen in the water and the degree of depletion of the same which will occur when sewage and water are mixed in practice. The best way to determine this effect is by trying. An experiment may have to be conducted in many places in order to determine whether or not the degree of purification effected by this or that device will furnish an effluent which, when mixed with the water into which it is discharged, will not produce a nuisance.

The disposal of sewage containing large amounts of industrial waste imposes an especial burden upon the designer and operator of sewage-disposal works. Wool-scouring wastes, and all others containing large amounts of fats; also tannery wastes, and other wastes containing germicides, are especially inimical to plants dependent upon biological processes. In such cases the wastes should be treated at the factory or well before being discharged into the sewer. A similar stipulation is necessary where large amounts of iron and sulphuric acid are discharged from wire and other metal works. Under ordinary conditions, iron should be precipitated and acids neutralized with lime before the sewage is discharged into the sewer. In some cities it will probably be desirable to separate the domestic sewerage system from the industrial. The study of the pollution of the Merrimac River, now in progress, might lead to such a conclusion.

It may be said that the first requisite for the proper disposal of sewage by oxidation methods is to ascertain the degree of oxidation required; the second is to use the method best adapted under the local conditions to produce the degree of oxidation, at the lowest cost per million gallons of sewage treated. Above all else, no general rule for the disposal of sewage can be laid down. Each locality has its own problem, and this demands its own unique solution.

DISCUSSION.

Rudolph Hering: Dr. Fowler states that the scientific solution of the sewage problem will not be attained until the sewage effluent does not deteriorate the stream into which it flows, and until no nuisance in connection with filter beds is created either by the sludge disposal, by objectionable odors, and by flies. He also adds the requirement that the expenditure should be strictly proportionate to the sanitary and aesthetic results achieved.

Dr. Fowler has thus well stated the case so far as he goes. But it is noteworthy that he does not mention the hygienic features by a single word, unless the word "nuisance" covers with him apparently what is included by the word "hygiene." A sewage effluent going into a river, according to him, should fulfill merely the condition that it will not deteriorate the stream, by which we should understand a fouling of the same.

We have a good deal of information regarding the discharge of typhoid bacilli into streams and into well water, whereby in both cases typhoid epidemics have been caused. Sometimes these bacilli seem to be very resistant, and have a long life. We have also evidence that tuberculosis is contracted from imbibing infected water, and that tubercle bacilli are, under favoring conditions, very resistant after remaining in sewage or in water. It has been stated that tubercle bacilli are more resistant to the influences of heat, antiseptics, light, cold, and decomposition than are any other of the other pathogenic bacteria (Krumwiede).

Dr. Fowler mentions as the last requirement of a scientific solution that the expenditure should be proportionate to the results. This is sometimes the most important requirement, because it generally decides the practical solution. This will continue to be the case until we have absolute and incontrovertible evidence regarding not only the nuisance but the hygienic requirements. Thereafter we shall have to pay the cost, whatever it may be.

Dr. Fowler's suggestion that we use the characteristics of the stream below a sewer outfall to decide whether a sewage effluent is satisfactory or not, will, in most cases, be considered both practical and sound. Wherever sewage is discharged into a stream, even when partly purified, the water is unsatisfactory hygienically, and should not be used either for drinking or bathing purposes, or for the taking of fish or shell fish. It is hygienically not only much more reliable, but generally also less expensive, to purify drinking water taken from such streams, and to cease taking fish therefrom, than simply to highly purify the sewage discharged into them.

Prof. Hofer's idea of fish ponds placed between sewage purification works and a river has been carried out at Strasburg. The results are good. The sewage effluent entering the ponds is first diluted by fresh water in quantities three to four times as great, and the ponds are stocked with fish, ducks, and geese. The water of the ponds is quite full of plankton, which serves as food for fish and fowl.

Dr. Fowler rightly thinks the sludge problem is the center of the entire sewage problem, because it has made most trouble, required the largest expense for treatment, and given the least satisfaction of all parts of a sewage-treatment works.

To the Emscher tank, which, it seems from the experience in Germany and the United States, will supersede the older methods, he gives but faint praise, but is now experimenting with it. He mentions at the outset a number of probable disadvantages:

First. The short time of retention for settlement necessarily causes sewage to flow upon the subsequent sprinkling filters with much variation in quantity between the day and night flow, or between the different hours of the day, all of which is not conducive to the best bacterial activity upon the filters.

The conditions could be modified and perhaps removed, as he suggests, by some form of equalizing tank.

The question which it seems would still remain to be solved will be whether the offensive conditions arising from storage in an equalizing tank will not be greater than the disadvantages of varying the doses upon the filter. We have already sufficient experience with sprinkling filters to know that intermittent dosing, occasional resting, and overdosing, do not radically injure the oxidation process. Whatever remedy may be required seems better applied to the filters themselves. The last word can be said only after more accurate and scientific data are available.

Second. Dr. Fowler thinks that fine filter materials could not be used for the oxidizing beds, because of the large amount of colloids which still would be discharged upon them. Here, too, the last word has not been said. It seems evident that the larger amount of colloidal matter which leaves the Emscher tanks than that which flows from septic tanks, can be satisfactorily oxidized in coarse-grained filters, provided that a sufficient area of bacterial surface is available for this oxidation and that sufficient oxygen is present. It may be necessary, therefore, to increase the depth of the beds, and possibly to improve their ventilation. This colloidal matter is, again, probably more easily oxidized in filter beds, than the shreddy matter rising from the septic sludge and flowing away from septic tanks.

Third. As the Emscher-tank effluent is not as much broken down as the septic-tank effluent, Dr. Fowler thinks that it is not as readily oxidized when discharged upon the subsequent filters.

While this is true theoretically, it is questionable whether it is true in practice, because it is well known that the septic-tank effluent generally carries with it a not insignificant amount of foul suspended matter, which must be taken care of by the filter bed, and either oxidized therein, or left to be dealt with in a subsequent settling basin.

The Emscher-tank effluent, although containing more colloidal matter, has not yet proved an obstacle in the subsequent oxidation. It seems probable that the finer colloidal matter may, with improved aeration, even be better taken care of in the filters than the suspended matter of more resistant material rising from the sludge in a septic tank. Here too more positive evidence than is now available is required.

Mr. Weston supports the new generally accepted theory that sewage oxidation is accomplished by dilution in ample quantities of water, by irrigation on land, and by filtration through contact, trickling, or intermittent sand filters.

It is now established beyond reasonable controversy that both air and water can oxidize sewage. The questions still to be answered refer simply to the manner in which the available oxygen can do the best work and to the quantities of the various kinds of sewage matter which can be oxidized by a given quantity of oxygen.

The oxidation of liquids is not difficult to accomplish. It is far more difficult to oxidize the solid suspended matter, and some solid matter is more difficult to oxidize than other solid matter. More discrimination should, therefore, be made between the various kinds of solids, because the required subsequent treatment may be much modified thereby.

Mr. Weston supports the view that screening the effluent coming from settling tanks is beneficial for the sprinkling filters; a view which has recently been much favored as against a single screening applied before settling.

Plain sedimentation for a period not exceeding about two hours is economical and efficient provided the sewage has not yet entered putrefaction. It seems as though this method will be favored in the future, not only before sewage enters oxidizing beds, but also before it enters running water for oxidation.

Mr. Weston considers that liquids should be treated aerobically and sludge anaerobically. This conclusion, while correct, is still somewhat vague, and may convey an incorrect impression if by an anaerobic decomposition we would expect offensive odors.

The sludge in the Emscher tank is decomposed anaerobically, but the resulting gases, being chiefly methane and carbon dioxide, are, therefore, nonodorous. If one removes some of the sludge at any depth in the tank, it is nonodorous when taken out, but after it is exposed to the air it becomes so, in proportion to the amount of nonresistant organic matter which is not yet decomposed. The final sludge from the Emscher tank contains none such nonresistant matter and is, therefore, not offensive, nor does it become so on standing.

Mr. Weston calls attention to the importance of sewage trade wastes, and properly concludes that in some cities they may have to be separated from the domestic sewage, either for the advantage of separate treatment or to allow the sewage to receive the most economical treatment. The sewage trade wastes, which at one time caused serious trouble in England, have not yet received sufficient attention in America because of our larger rivers and more scattered works. Their separate treatment will be one of the pressing questions in sewage-disposal works of the future because of their varying and sometimes serious effects upon the purification of domestic sewage.

METHODS OF SLUDGE DISPOSAL.

Karl Imhoff, Essen, Germany.

Sludge results from all methods of treating sewage. The problem of handling this sludge satisfactorily is just as important as the treatment of the sewage itself, for experience has shown that sludge which has been poorly handled is much more objectionable than the worst sewage.

DISPOSAL OF WET SLUDGE.

Fresh wet sludge ordinarily contains more than 90 per cent of water, and can be pumped out of settling tanks in the same way as sewage or water. It would, therefore, seem a simple matter to get rid of it by pumping it onto low-lying ground and allowing it to remain there with the hope that it might in time become firm. Such treatment is unfortunately almost always without success. Sludge deposited in deep layers does not dry, and the ground remains wet. This treatment is therefore useful only when the sludge is spread out in very thin layers. The sludge can also be discharged into shallow trenches. Under these conditions the sludge dries in some weeks, and can be plowed into the ground for agricultural purposes.

The sludge thus becomes used, as it were, for irrigation, just as with sewage. There is the disadvantage, however, that a large area is necessary, and that objectionable odors can not be prevented.

In the case of cities located near the ocean the problem becomes simpler. Such cities can send their sludge out to sea in ships and allow it to sink. Since it becomes necessary to carry the sludge a considerable distance from the shore, the cost of this method of disposal is quite high, and it is very probable that some of the cities which have been using this method of sludge disposal could now accomplish the desired ends more cheaply by adopting another method of disposal.

In general one can say with assurance that the cases are very few where it is desirable to dispose of sludge in a wet condition.

DISPOSAL OF DRY SLUDGE.

As soon as sludge has been properly dried, it has lost most of its objectionable characteristics. In any case, dry sludge can be used as easily for agricultural purposes as other kinds of fertilizer. Its value, however, for agricultural purposes depends more on its physical characteristics than on its fertilizing value.

Dry sludge can also be used, just as well as ordinary earth, for filling low land. In almost every case this method of disposal is the most economical, if it is not possible to use the sludge for agricultural purposes. To cities which use their refuse for filling this method of sludge disposal is particularly adaptable, because the dry sludge has a volume of only about one-fifth of that of the city refuse, and, if a city has sufficient ground for dumping its refuse, there will also be sufficient area for the sludge.

In cities where the refuse is burnt, consideration should be given to the possibility of burning the dry sludge with the refuse. In such an event, however, there is the danger that the slag will not be so good. In addition to the incineration of sludge other methods of artificial disposal of dry sludge are not worth considering; such, for example, as using it for the production of gas or for the extraction of the fats contained in it.

As incineration is carried out on a large scale in only one instance (Frankfurt am Main), it may be concluded that for the disposal of dry sludge there are left only the two natural methods, namely, its use for agricultural purposes and for the filling of low land.

METHODS OF DRYING.

From what has already been said, we may conclude that the best system of sludge disposal is that in which the sludge is first dried. There are, of course, difficulties connected with this drying.

Science has, up to the present time, interested itself principally in artificial methods of drying. Of first importance in this connection is the pressing of sludge, which has been used for many years in England. The excess water in the sludge is pressed out through filter cloths. Sewage sludge can be pressed only when it is properly treated, for example, with lime or coal powder. This system is a good one, and for the foregoing reason is especially applicable to chemical precipitation works, where the chemicals necessary for the precipitation are added to the sewage. The cost of the system is, however, so high that, outside of England, it has been very little used.

In comparison with sludge pressing the centrifugal drying machines used in Germany (Frankfurt and Hannover) are a step in advance, since the fresh sludge is handled without the addition of chemicals. There is, however, the serious disadvantage that the water separated from the sludge is much more objectionable than in the case of sludge pressing. This water contains a very large part of the organic matter of the sludge.

A more natural treatment and one especially applicable for small plants, is the mixing of the wet sludge with drying matter, which absorbs the moisture. Refuse and street cleanings are especially applicable for this purpose, if the sludge is to be used for agricultural purposes.

The simplest of all methods of drying is just to discharge the sludge upon a drying bed, which should consist of 10 inches of porous material, with a perfectly horizontal surface, and underlaid with drain pipes laid approximately 12 feet from center to center. It must not be forgotten that there should be spread over the surface of the bed a thin layer of fine sand, which will have to be frequently renewed.

This simple natural arrangement for drying was formerly very little used, because all attempts to drain fresh sludge were unsuccessful. The sludge must first be made drainable. Without question this can be done by artificial means, with the addition of lime or coal powder, in the same way as with sludge pressing. But all these methods of drying are uneconomical.

Automatically the sludge becomes drainable while undergoing a process of natural decomposition. We have known this fact for a long time from the " septic tanks," through which the sewage slowly flows, and as a result of it being in contact with the decomposing sludge becomes itself foul and smells. In comparison with these septic tanks a step in advance was made by separating the decomposing sludge from the flowing sewage by removing it into a separate tank.

This idea of separate sludge decomposition was, so far as I know, first brought forward by Mr. H. W. Clark, of Boston, in the year 1899. It was not possible, however, in the experiments made by Mr.

Clark, as well as in other places, to effect in a separate sludge tank as good a decomposition as with the ordinary septic tanks.

The first success along these lines was made in the year 1906 at the sewage disposal works of the Emscher Genossenschaft in Essen. The type of works referred to is spoken of as the Emscher tank, a special type of double-deck tank, which consists of an ordinary settling chamber and a sludge decomposition chamber below, through which there is no flow.

After a short ripening time there was found in these sludge decomposing chambers a sludge black in color and with a slight odor of tar. In spite of small water content, ordinarily of about 75 per cent, the sludge flowed easily through pipes, and when spread upon a drying bed to a depth of 10 inches became firm and spadable in a few days. The decomposition was practically odorless and the sewage flowing out of the settling chamber was totally unaffected by the decomposition of the sludge.

Since we know that it is possible with separate sludge chambers to have the principal advantage of the septic tank, namely, the drainability of the sludge, the septic tanks have lost their importance. Their disadvantages, especially the objectionable odor of the effluent, render them impossible for many purposes. They are to-day suitable only for very small plants.

In most cases it is desirable to keep the sewage fresh, or, in other words, to treat it in ordinary settling chambers and to remove into a separate chamber only the sludge, which requires decomposition, in order that it can be easily drained and dried. It is not to be assumed that the Emscher tank is the only arrangement for bringing about these results. It is possible, without question, to bring about the natural decomposition, which takes place in Emscher tanks, with any properly built tank filled in the right way with sludge and operated according to certain principles. I do not yet know of any plants with separate sludge tanks, however, where exactly these results have been obtained. And it seems to me that all possible scientific methods of bringing about these results with plants in which the sludge is pumped from the settling tanks to special decomposition tanks would be much more expensive both for construction and operation.

Entirely independent of these technical details, it can be said that sludge is best dried upon a properly built drying bed, and that the proper preliminary treatment of the sludge is its decomposition in separate chambers which do not have any flow of sewage through them.

PRACTICAL TESTS OF SLUDGE.

In the sense of what has been said, good sludge may be considered as sludge which dries quickly and has no objectionable odor. The following information shows the possibility of easily determining the character of sludge:

Appearance and odor.—Good sludge is black, and uniformly granular. It moves easily; it has a slight odor of tar or burnt rubber. Bad sludge is gray, full of fibers, soapy, sticky, and has a bad odor.

Adhesiveness.—A white enamel-lined dish pan is filled with sludge and then emptied so that only enough sludge remains to just cover the surface of the enamel. Good sludge will separate itself at once from the water, so that, in 10 or 15 seconds, the surface is broken up by white lines. Bad sludge sticks to the entire surface. This experiment is especially important, because it gives the information at once.

Gas content.—Newly withdrawn sludge is placed in a measuring glass to a height of 1 foot. After 6 hours, good sludge separates itself from the water, which collects below the sludge. With bad sludge, the water collects on top.

Drainability.—Sludge is placed on a sand filter to a depth of 10 inches. In the case of good sludge, considerable clear water will drain out in the first few hours. In 3 days, during dry weather, it will be firm and spadable. With bad sludge, only a small amount of water drains out of the sludge, and this takes place very slowly.

CONCLUSION.

The two best methods of disposal of sludge are (1) its use for agricultural purposes, and especially (2) filling of low land.

In both cases, the sludge must first be dried, and this is best effected upon a drying bed after the sludge has decomposed, in an inoffensive, odorless manner, in a separate tank through which sewage does not flow.

DISCUSSION.

Rudolph Hering: As Dr. Imhoff has taught us how to dispose of sewage sludge in an inoffensive manner, after almost half a century's vain trials to accomplish that end, his paper is of unusual interest and importance.

The difficulties heretofore have been, partly, a very slow natural drying of the sludge, sometimes requiring over a year, and a corresponding retention of its offensive condition. This was due to the tendency of sludge to hold water by capillary absorption into the fine pores of the putrescible organic matter constituting a large part of it. The actual putrefaction of this organic matter, except immediately at the surface, would take place because of the lack of an excess of free oxygen.

The process described in the paper produces for the first time a quick-drying material and no objectionable odors. The sludge is first separated from the liquid and separately decomposed, as was first tried by Dibdin in secondary tanks at Pimlico Pumping Station, London, in 1884.

The sludge is separated in double-decked tanks, the lower one being under water, and both are somewhat similar to those first used by Travis, at Hampton in 1900. Both the Dibdin and the Travis methods, however, still produced very offensive sludge.

Inoffensive sludge was first produced by Dr. Imhoff, in the new Emscher tanks, in 1906, by allowing no sewage whatever to flow through the lower of the two superimposed tanks where the sludge decomposition was taking place. This practical exclusion of flowing fresh sewage in the lower chamber allows the sludge to be inoffensively decomposed. It is found that substantially the only classes of bacteria which remain present and active in a ripened tank are those which produce marsh gas and carbon dioxide gas, both of which are inodorous. The other classes seem to have been eliminated. After a few months the putrescible organic matter has thus disappeared from the sludge, so that when withdrawn and exposed to the air it no longer becomes offensive.

This long-desired condition is accompanied by the further great advantage that, being deprived of the fine organic matter, the sludge has become porous, by the generated and compressed gases and is, therefore, easily drainable, which permits its drying within a few days.

The process described by its discoverer, therefore, constitutes the most important advance made in sewage treatment and disposal for a number of years, as it obviates the offensive odors heretofore inseparable from sludge disposal, and reduces the bulk of sludge to be handled and disposed of to quite a small fraction, sometimes to one-eighth, of what heretofore was found necessary.

The first American experiments with the new process were made at Philadelphia, by the Bureau of Surveys, and, in Chicago, by the Sanitary District. More recently an experiment on a practical scale has been made at Worcester, Mass. In all of them, although the sewage differs materially, inoffensive sludge has been economically produced by natural means.

Dr. Karl Imhoff: When an Emscher tank is put into operation, it must first pass through the ripening period. At the end of this period, the evolution of gas is very strong, and the sludge is not yet sufficiently decomposed. Sludge which is not yet decomposed is sticky, and that makes it difficult for the gas bubbles to penetrate it. Therefore, it is possible that large masses of sludge will rise in the decomposing chamber, and that it will be necessary to temporarily draw off some of the floating sludge. As soon as the ripening period has passed, the sludge has lost its stickiness, and allows the gases to easily pass through it. Unless grave errors in operation have been made, the sludge then rests permanently at the bottom.

DISPOSAL OF CITY REFUSE

Rudolph Hering, D. Sc., Consulting Engineer, New York City.

INTRODUCTION.

The ways and means of disposing of a city's refuse have received much attention and some progressive development during the last quarter of a century, on account of the increasing tendency to give more study than before to city sanitation and cleaning, and on account of the rapid growth of cities and of the correspondingly increased mass of rejected matter to be dealt with.

England led the way, by combining most of the different classes of refuse into one compound, and taking it to furnaces for incineration. This destruction by fire, under proper manipulation, could be effected without offensiveness, and left only clinker and ashes which could be utilized for various purposes. The high temperature of combustion, necessary for the desired destruction of all of the waste organic matter, offered the further possibility of utilizing the heat for steam production. A financial return from the two products, clinker and steam, materially reduced the cost of disposal.

America, in many cities, adopted another system. It was recognized that the kitchen or food wastes, called garbage, were valuable, when fresh, as food for pigs. The domestic garbage in many of the smaller cities, and the hotel garbage of the larger cities, have therefore been and still will be profitably utilized in this way. It was also found that the garbage of a number of large cities in the United States contained a large amount of vegetable and animal oils and grease which it was profitable to extract and sell at good figures. Private companies were formed to engage in this business, which is now called garbage reduction, and many of the largest American cities have works for the obtaining of this oil and grease, and, as a by-product, a fibrous material called tankage, which is sold as a filler for fertilizers.

Garbage feeding and reduction, however, leave all the other parts of a city's refuse still unprovided for, and other means are required for their proper disposition. Such other means are incineration, burial and plowing into land, and land making by dumping.

Public hygiene demands that all classes of city refuse be disposed of in a manner to prevent disease and nuisance. Public economy demands that this be done at the least expense to the community. The subject must therefore be treated from these two aspects, and a broad discussion requires, first, an analysis of a city's refuse, giving consideration to each class, as to its liability to transmit disease and cause nuisance, or both, and, secondly, a knowledge of the practicable means for collecting and disposing of all the refuse in the most efficient and economical manner.

The classes into which city refuse may be divided are as follows:

Garbage.--This material consists chiefly of the food waste from kitchens, markets, and slaughterhouses, and is rejected animal and vegetable matter in solid and partly liquid form. Within a few days, depending chiefly upon the temperature, it enters into putrefaction and becomes offensive. It contains from 1 to 4 per cent of oils and grease, averaging in American cities about 3 per cent, but in European cities it rarely exceeds 1 per cent. If it does not contain condemned food, the sanitary dangers of garbage lie in the opportunities it gives for fly breeding.

Dead animals.—In large cities these are generally utilized for the profit derived from the sales of oils, grease, hides, and bones. The sanitary dangers lie in possible infection and offensiveness.

Night soil.—This refuse is either dumped into sewers or utilized as manure. If dumped into sewers, it is dealt with as it would be if directly discharged into them as sewage at the point of origin.

Manure.—When it is economical to utilize manure for agriculture, this is done. Otherwise, it is incinerated, or, as in the cities of the Central West of the United States, it is frequently wasted by dumping. Agricultural use, under proper precautions, is a sanitary one, and, where economical, it is usually practiced.

Street sweepings.—This material varies in composition with the kind of pavement and traffic and the distance from unpaved roads. In Europe it is generally utilized for agricultural purposes, while in America it is generally wasted by dumping. only a small fraction of the cities using it in agriculture or incinerating it. From the hygienic point of view, the dust is the most objectionable accompaniment.

Ashes.—This material is either utilized for road or land making, or, if combined with garbage, for incineration, because it contains unburnt coal, varying from about 3 per cent in Berlin to nearly 30 per cent in England and averaging about 25 per cent in the United States. The dust is its most objectionable hygienic feature. In those American cities where oil and natural gas are used for fuel it is not practicable to count on any unburnt coal in ashes for garbage incineration.

Rubbish.—This consists of the miscellaneous material which is not comprised in the above-mentioned six groups. It is made up chiefly of wood, paper, straw, rags, metals, sweepings, and the like, and of trade refuse. Its most objectionable parts are the dust and disease germs which it may contain.

For the purpose of this discussion it may be most expeditious to divide the entire subject into three parts, taking up, first, the sanitary aspects, including the prevention of disease and nuisance, secondly, the financial aspects, and, thirdly, the final conclusions resulting from the entire discussion.

SANITARY ASPECTS.

The following table conspicuously indicates the sanitary methods by which all of the various classes of refuse may be safely treated:

Sanitary methods of refuse disposal.

Refuse.	Incineration.	Reduction.	Burial or plowing into ground.	Dumping.	Feeding.
Garbage	Steam and ashes.	Grease and fertilizer.	Decomposition and fertilizer.		Food for pigs.
Dead animals	do.	do.	do.		
Night soil	do.		do.		
Manure	do.		do.	Land making.[1]	
Street sweepings.	do.		do.	do.[1]	
Ashes	Steam and clinker.			do.[1]	
Rubbish	Steam and ashes with or without prior picking.			do.[1]	

[1] Not always advisable.

Incineration, it will be seen, can dispose of all classes without exception. It is the method almost exclusively preferred in Europe, especially where ashes contain a high percentage of unburned coal. It is a method which will cause the destruction by fire of all disease germs and of all dead organic matter that might be subject to decomposition, to breeding insects, and be a nuisance.

There can hardly be a question that among the various available methods for disposing of the entire city refuse, incineration, if the heat is maintained at a sufficiently high temperature, gives the best assurance of a rapid destruction of pathogenic bacteria and avoidance of nuisance caused by the putrefaction of organic matter. It is therefore preferred, unless financial considerations weigh too heavily against it. For the final disposal of rubbish, it is the only thoroughly satisfactory method.

It has been the custom for centuries to allow a picking over of the rubbish, whether on streets or on dumps. Within the last quarter of a century there have been arrangements in a number of cities for picking out of the rubbish and selling rags, paper, wood, glass bottles, and metals. It has been found profitable, in some cities, to engage in this business. London, Paris, Berlin, and other European cities have more or less countenanced the custom. In New York, Boston, Buffalo, and other American cities it has also been practiced.

On the other hand, considerable opposition has arisen to the practice. It has been pointed out that among all of the various classes of city refuse there is none more likely than the general rubbish to contain pathogenic bacteria. Discarded bedding and furniture, the sweepings and the dust from sick rooms usually find their way into the general rubbish. It is therefore not unlikely that some of the matter picked out has been infected by and still retains pathogenic organisms. Although there does not seem to have been a well-authenticated case of disease transmission through well-organized rubbish picking there can be no assurance that such will not occur. And there is the further aspect that the moderate profit to be gained from such picking might well be relinquished, in view of the assurance against a possible source of disease and the abolition of what must be considered a filthy trade. For these our modern communities, in the endeavor to clean up their cities, should be quite willing to pay the price.

Reduction is practiced in large cities for the treatment of garbage and dead animals. If the works are properly designed and carefully as well as intelligently operated, there should be no danger whatever of transmitting disease germs. The material is subjected to a high temperature sufficiently long to abstract all the oils and grease, and therefore incidentally to destroy all pathogenic bacteria.

There is great fear, however, when conducting this process, of creating a nuisance. Owing to the ease with which garbage enters the state of putrefaction, it is necessary to keep reduction works scrupulously clean. And owing to the unpleasant odors apt to arise at the works it is necessary to have good ventilation and also a subsequent treatment of some of the vapors and liquids which result from the process.

These contingencies of the reduction process make it advisable to locate the works in a neighborhood where the possibility of occasional unpleasant odors would not materially injure the value of adjoining property.

Burial or plowing into the ground is practiced in cities where works of incineration or garbage reduction are impracticable or expensive and where this method is limited to all classes of refuse, except ashes and rubbish, for which a subsurface disposal has no advantage. It is the method which is practiced by the city of Berlin and some other large cities in central and eastern Germany, and in a large number of small cities in Europe and America. By burial or plowing into the soil the disease germs perish, and the decomposition of the organic matter is gradually accomplished under conditions which do not cause a nuisance. After one to five years a complete decomposition has taken place, and the soil can be used over again for the same purpose.

Dumping for land making is practiced in cities for the disposal of manure, street sweepings, ashes, and rubbish. This disposition, however, can not be indorsed without reserve as being sanitary under all conditions. Manure and street sweepings, although thus disposed of in many of the western cities in America, may, by fly breeding, be an indirect cause of disease transmission. Still less commendable is the dumping of rubbish, because this is most apt to contain disease germs in discarded articles and sweepings from sick rooms and hospitals. Unless manure, street sweepings, and rubbish can be incinerated or plowed into the ground, dumping is the least objectionable alternative; but special care must be given to the prevention of fly breeding and in covering the dumped material with clean earth.

Care should also be taken to prevent the lighting of fires in the rubbish dumps, as burning under such circumstances is always a source of nuisance.

When ashes, which are the best refuse material for this purpose, are used for dumping and land making, care must be taken to prevent a blowing away of the dust by the wind, as this usually constitutes a serious nuisance.

Dumping into rivers or at sea may yet be mentioned, but it must be recognized at once that such dumping can be permitted only in rare cases. Garbage, and organic matter in general, when dumped, will float, and may drift to the shores. The other and heavier matters, which are generally mineral, such as ashes and the like, will sink, and they could be disposed of on shore, generally without objection. Dumping of any refuse into large bodies of water is not to be considered as a permanently satisfactory means of refuse disposal.

Feeding to pigs of garbage separately collected from dwelling houses, hotels, restaurants, and markets is practiced in most small and some large cities, and if the garbage is fresh, collected daily and properly handled, there can be no reasonable objection to this method of disposition, as no disease germs are expected to be contained in our food wastes.

When it becomes old and rotten, and when it contains the meats and vegetables that have been condemned by health authorities, the garbage must naturally not be fed to animals. Old garbage is also sanitarily dangerous as a favorable nidus for fly breeding.

When garbage is either not fed, or is old, it should be mixed with ashes, in order to reduce the chances for fly breeding, and to hinder its becoming offensive and creating a nuisance.

FINANCIAL ASPECTS.

After having stated the several satisfactory means of disposal of the different classes of refuse, which will not allow of the dissemination of disease or the creation of nuisance, we must now consider the cost of carrying them out, because upon the cost will finally depend the selection of the most suitable process for any particular locality.

When considering the financial aspects, we should not follow the former method of limiting the cost to that of final disposition. We might just as well say, offhand, that the cheapest disposition is shallow burial or dumping far out at sea. Yet it may cost a city much more to get the refuse delivered to such probably satisfactory points of disposal than to save in the cost of such transportation and add in the cost of some treatment. It was found, in one large American city, that although the reduction process was itself cheaper than the incineration process, as a whole proposition it was cheaper to adopt incineration, when the costs of collection and transportation were included in the estimates.

Therefore, before recommending a method of refuse disposal for a city we should examine into and estimate the cost of collection and transportation as a necessary part of the entire work of disposal.

For the reduction system, when it becomes necessary or desirable to collect garbage separately from the other refuse, or when it is desirable to utilize ashes for filling in land, dead animals for producing salable articles, and when night soil is to be added to the city sewage, it will be necessary to collect separately, at different times and with different means, the different classes of refuse thus to be disposed of. For the incineration system, when most of the refuse can be collected and disposed of together, no such separation is necessary.

Further, a separate collection of garbage may have to be made daily, or every two days; whereas for a collection of some other materials once a month would be sufficient.

The collection may be made by horse and wagon, by motor wagons, and by odorless excavators or other special apparatus.

The cost of the collection may, therefore, greatly vary with the necessities of final disposal for each class, with the method of treatment, and with the frequency and character of the collection. This cost will be an integral part of the entire cost, and should be considered as carefully as any of the other parts. A separate system of collecting all of the refuse will generally be more expensive, more complicated, and less convenient at the house than a combined system of collecting.

Therefore, to ascertain the true cost of a complete system of refuse disposal, we should ascertain the annual cost of collection from the house, or point of origin, to the point of final disposal, together with the annual cost of the treatment itself, and of the disposition of the products. This annual cost should comprise the interest on the investments for both the collecting and disposal plants, a proper percentage for depreciation and repairs, and the entire operating expenses.

To balance the expense for such a system of disposal, it is necessary to credit it with whatever revenue can be derived from the disposition or sale of the products obtained therefrom, and with the sanitary advantages that are gained. The possible credits may be stated as follows:

Incineration produces steam, clinker, and clean ashes.

Reduction produces oils, grease, and fertilizer.

Burial or plowing into the soil produces a slight, if any, increase in the salable value of the land.

Dumping in low places produces an increase in land values.

Feeding produces value for piggeries.

Among these credits incineration, reduction, and feeding bring the largest returns. Steam can be used to unload, to convey the refuse to and from the plant, and to operate most parts of the works. It can be used for heating, for furnishing power to plants for pumping water and sewage, for charging storage batteries, and for making electricity, ice, and other products. Because the refuse is not a homogeneous fuel and because it varies in different seasons and in different localities of the same city, it can not yield as high a return as steam produced from coal or other good fuel. One pound of refuse has been found to produce from one-half pound to 1¾ pounds of steam. But it will be useful in diminishing the cost of refuse incineration to that large extent.

It will generally be possible to narrow down the available projects for disposing of the bulk of city refuse to two or three. As an example, and calling attention only to the principal elements, let us assume that the question of economy lies between general incineration, as one project, and the reduction of garbage, together with the incineration of most of the other parts of the refuse, as the other project. Let us further assume that dead animals will in both cases be separately collected and disposed of, that the night soil of outlying sections of a city will in both cases be dumped in a proper manner and at a proper time into large city sewers, and, finally, that manure, street sweepings, ashes, and rubbish must be incinerated, there being no suitable places for dumping or utilization.

GENERAL INCINERATION WORKS.

Locate suitable central points where incinerators can be built, convenient for the reception of refuse and the delivery of steam and clinker. Estimate the annual cost, including fixed charges and operation, as follows: First, of the wagons and other means of collecting from house to works all garbage, ashes, and rubbish combined, and, second, of the works for incineration.

The sum of these two estimated costs will give the probable annual cost of the entire plant from origin to finish.

This sum must then be credited with the annual values of steam and clinker, these being the products derived from the incineration.

The result will be the net annual cost to the city of collecting and finally disposing of the above parts of the general refuse.

REDUCTION AND INCINERATION WORKS.

(A) Locate a suitable place where the reduction process can be carried on economically and conveniently for the reception of the garbage and delivery of the products, with a capacity to serve, if practicable, the entire city.

Estimate the annual cost, including the fixed charges and operation, as follows: First, of the wagons and other means of collecting the garbage from house to works; second, of the works for reduction.

The sum of these two estimated costs will be the probable annual cost to the city of the collection and reduction of the garbage.

This sum must then be credited with the annual value of the products of reduction, as derived from the sale of oils, grease, and fertilizers. The result will be the net annual cost, perhaps profit, of disposing of the city's garbage.

(B) Locate suitable central points where incinerators can be built, which will be convenient for the reception of ashes and rubbish, and delivery of steam and clinker. Estimate the annual cost, including fixed charges and operation, as above, of the collection and works for disposal of ashes and rubbish, if these are to be incinerated together. If only the rubbish is to be collected and delivered for incineration, then there should be added the cost of collection and final disposition of the ashes by dumping.

This cost should again be credited with the annual value of the steam and clinker, and perhaps of the landmaking by the dumping of ashes.

By adding the results obtained under A (reduction of garbage) and B (incineration of rubbish and ashes, or incineration of rubbish and dumping of ashes) we obtain the total net annual cost to a city of collecting and finally disposing of the above parts of the general refuse.

A comparison between these estimates of cost, of both collection and incineration of garbage, ashes, and rubbish as one project, and of both collection and reduction of garbage and of both collection and incineration of rubbish and dumping of ashes as the other project, will indicate the most economical method in the city for which these cost estimates have been made.

Such a procedure of ascertaining the least cost will best serve the financial interests of a city. It becomes practicable thereby to select, among the several satisfactory systems of refuse disposal, the one which is both sanitary and the least expensive to the community.

CONCLUSIONS.

The best method of disposing of a city's refuse is dependent largely upon local conditions which must be carefully considered and weighed before the most suitable system can be selected.

In European countries there seems to be but little choice. In England and western Europe, where high-grade coal is used, incineration of the entire refuse appears to be both satisfactory and most economical. In central Europe, where a lower grade of coal is used, plowing in and burial have been the most economical processes, although incineration is now frequently being recommended as a more satisfactory and a more permanent solution of the question.

In America the richness in grease of city garbage, the wastefulness of coal, or the use of oil and natural gas for producing heat and power have brought about such different conditions in different cities that the European method of general incineration does not in all cases yield the most economical method of refuse disposal. It is therefore necessary to analyze these conditions for each city, to consider singly the different parts of the general refuse, and to estimate the combined cost of collection and disposal for the local conditions, as above outlined, in order to determine which of the several processes available should be recommended to the community.

RAPPORT SUR LES ORDURES MÉNAGÈRES.

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La question des ordures ménagères a, de tout temps, préoccupé les hygiénistes soucieux d'assainir les agglomérations humaines. Mais ceux-ci se sont toujours heurtés à la routine ou à la mauvaise volonté de ceux dont ils voulaient défendre la santé. Et l'on peut dire que, si la plupart des hommes comprennent l'intérêt qu'il y a à maintenir les abris des animaux domestiques en bon état de propreté, ils n'aperçoivent pas le plus souvent combien il est nécessaire de nettoyer leurs propres habitations.

Il est reconnu depuis longtemps que les ordures ménagères sont susceptibles de propager les maladies. Or, quelle est l'habitation dans laquelle il n'a pas existé ou dans laquelle il n'existe pas de maladies contagieuses, souvent fort graves?

La santé publique exige donc non seulement que les habitations soient débarrassées le plus rapidement possible des ordures ménagères, mais elle exige également que ces ordures ne puissent être nuisibles une fois enlevées des habitations.

La question se présente par conséquent pour les municipalités des grandes villes:

1°. Collecte des ordures ménagères dans les ménages et à l'intérieur des habitations, de façon que les procédés employés ne puissent nuire en rien à la santé des occupants.

2°. Enlèvement des ordures hors des habitations et transport au loin avant tout commencement de fermentation et sans répandre ni poussières, ni mauvaises odeurs.

3°. Destruction ou utilisation des ordures ménagères, de telle sorte que la santé des personnes ne puisse avoir à souffrir.

J'étudierai les divers modes en usage pour chacune de ces opérations, en indiquant ceux qui me paraissent devoir être particulièrement recommandés.

I. Collecte.

L'on a souvent préconisé des moyens expéditifs pour faire disparaître les ordures ménagères, au fur et à mesure de leur production, et pour éviter d'en avoir à faire la collecte dans chaque ménage.

L'un de ces moyens consisterait à pourvoir toute maison de tuyaux de chute, comme your les matières de vidange, et à faire évacuer les ordures vers l'égout à l'aide d'une pression d'eau qui les y chasserait.

Ce procédé n'a pas eu de succès; on a reconnu en effet, d'une part, qu'en raison de leur composition même les ordures ménagères ne tarderaient pas à obstruer les tuyaux de chute et, d'autre part, que le volume considérable de ces ordures finirait par boucher également les égouts publics.

D'autres personnes ont recommandé l'incinération, dans le ménage même, au moyen d'un fourneau de cuisine construit à cet effet. Mais ce procédé, évidemment susceptible de rendre de grands services à l'hygiène, ne peut être appliqué que dans les endroits où le fourneau de cuisine fonctionne d'une façon régulière et non dans ceux où la cuisine se fait le plus souvent au gaz.

D'ailleurs, même si l'on employait l'un de ces procédés, incinération dans le ménage ou escamotage au moyen d'un tuyau de chute, il resterait toujours à enlever les matières inertes telles que la ferraille, les débris de vaisselle, les boîtes en métal, etc.

Mentionnons également une méthode d'évacuation en usage dans quelques maisons de Paris: Elle consiste en une conduite spéciale établie pour la descente des ordures ménagères; à chaque étage est ménagée une ouverture munie d'une porte, communiquant à une petite chambre ayant la forme d'un grand entonnoir raccordé à la chute; avec un grand clapet de retenue placé sur la pénétration de la chute, qui se prolonge jusqu'au-dessus de la toiture pour la ventilation. Les détritus jetés dans cette chute tombent dans un récipient placé au bas. En théorie, ce procédé a pour but de faire disparaître les ordures du ménage avant tout commencement de fermentation, mais en réalité on évite simplement leur transport par les cages d'escalier. Il peut arriver, en pratique, que certaines des matières jetées dans cette descente restent collées aux parois, fermentent ensuite, dégagent de mauvaises odeurs et attirent les insectes qui deviennent ainsi un grave danger pour les habitants. La porte du réduit ne ferme d'ailleurs pas toujours hermétiquement, quelquefois même elle reste ouverte. Enfin la chute peut se trouver obstruée, des détritus peuvent être répandus sur le palier, de sorte que ce système est susceptible de devenir tout-à-fait anti-hygiénique.

Personnellement, en ce qui concerne la collecte des ordures ménagères dans les ménages, j'estime que le meilleur procédé consiste à recueillir ces ordures dans des boîtes en tôle galvanisée ou en toute autre matière parfaitement étanche.

Après expérience, c'est là le procédé qui m'a paru le plus pratique et celui dont il est le plus facile d'assurer le bon fonctionnement. Les autres systèmes sont susceptibles de gêner les locataires par leur imperfection ou de les mettre à un moment donné dans l'impossibilité de se débarrasser de leurs ordures ménagères par suite de l'obstruction ou du mauvais fonctionnement de l'appareil qu'ils nécessitent.

Il est bien entendu que je n'ai en vue, dans tout ce travail, que les agglomérations importantes et nullement les campagnes où les choses sont beaucoup plus simples et peuvent, par suite, être solutionnées avec beaucoup plus de facilité.

Après la collecte des ordures dans chaque ménage, il y a lieu de se préoccuper de la collecte générale dans la maison.

Pour la collecte générale dans la maison l'on peut se servir de divers procédés:

1°. Les boîtes de chaque ménage sont déversées dans un ou plusieurs récipients suivant l'importance de l'immeuble; ces récipients sont nécessairement pourvus d'un couvercle amovible et sont chaque jour vidés dans les voitures d'enlèvement.

2°. Un autre procédé consiste à recueillir les ordures provenant des boîtes de chaque ménage dans des boîtes d'une construction spéciale et uniforme, fermées d'une façon étanche par un couvercle approprié. Quand la collecte générale dans la maison est terminée, l'on ferme les boîtes au moyen de ces couvercles, puis le service d'enlèvement des ordures ménagères, au lieu de déverser le contenu des boîtes dans des voitures spéciales, enlève les boîtes elles-mêmes, laissant chaque fois dans l'immeuble autant de boîtes vides qu'il a enlevé de boîtes pleines. Ce procédé offre toutes les garanties nécessaires à la santé publique et serait certainement généralisé depuis longtemps déjà si le poids considérables des récipients n'avait pour conséquence d'augmenter les frais de transport d'une façon très notable.

3°. Enfin le procédé que je préconiserais comme pouvant offrir toutes les garanties nécessaires à la santé publique, tout en étant beaucoup plus économique que le précédent, procédé que j'ai décrit dans un rapport présenté à la Société de médecine publique[1], ce serait l'emploi de sacs appropriés à la circonstance.

Le poids de ces sacs serait insignifiant comparativement à leur contenu, leur enlèvement serait des plus faciles et, dans les voitures chargées de l'enlèvement, ces sacs n'augmenteraient que fort peu le volume des ordures ménagères.

L'enlèvement des ordures hors de la maison devrait se faire pendant la nuit, si l'on adopte le système consistant à déverser directement les récipients dans les voitures. Si au contraire la collecte générale dans la maison se fait dans des boîtes fermées d'une façon étanche, une fois la collecte terminée, ou dans des sacs ficelés après avoir été remplis, il n'y a aucun inconvénient à ce que l'enlèvement de la maison ait lieu dans la matinée, puisque dans ces systèmes la projection des poussières sur les passants n'est pas à craindre.

Je suis également d'avis que les récipients d'immeubles, quel que soit le procédé adopté, doivent être enlevés dans la maison même par le service d'enlèvement. Sous aucun prétexte en effet les récipients ne devraient être déposés devant les immeubles et le chiffonnage, pas plus dans la maison que sur la voie publique, ne devrait être toléré.

Il va enfin de soi, que les récipients d'immeubles, quels qu'ils soient, doivent être désinfectés journellement. Je suis également d'avis que l'enlèvement des ordures de la maison doit se faire chaque jour pour éviter leur fermentation.

II. Enlèvement.

La collecte générale étant faite à l'intérieur de chaque immeuble de la façon que j'ai indiquée plus haut, nous arrivons aux procédés d'enlèvement des ordures ménagères.

Ces procédés diffèrent naturellement selon la localité, les facilités de communication et les moyens dont on dispose.

Dans les villes à rues étroites, tortueuses ou à pente trop rapide, où les voitures ne peuvent circuler, comme dans la plupart des villes du Maroc, par exemple, l'enlèvement des ordures se fait avec des ânes portant des paniers de chaque côté, paniers dans lesquels les habitants déversent tous leurs détritus. Malgré ce mode primitif d'enlèvement, l'on a pris dans certaines villes, et notamment à Tanger, la précaution hygiénique de couvrir les ordures d'une toile quand les paniers sont pleins. Il faut dire qu'à Tanger il existe une commission d'hygiène qui tient la main à tout ce qui peut sauvegarder la santé publique dans la mesure des moyens dont elle dispose. Ailleurs, l'on se sert de véhicules plus ou moins appropriés aux circonstances.

A notre avis il est essentiel que l'enlèvement se fasse de façon à ne pas répandre de poussières; pour cela il est nécessaire que le véhicule ne soit pas trop élevé et ne dépasse pas 1 m. 40 ou 1 m. 50 de hauteur au-dessus du sol, à l'endroit où doit se faire le déversement.

Les voitures devraient être construites de telle sorte que les passants soient à l'abri de la projection des débris ou des poussières et de manière que les ordures soient entièrement enfermées dans la voiture quand le chargement de celle-ci est terminé. On peut ainsi traverser les rues d'une ville sans danger pour ses habitants.

L'on a imaginé de nombreux types de voitures. Je ne veux pas ici dire quel est celui qui me paraît le meilleur parce qu'un système convenant fort bien dans un endroit pourra, bien souvent, ne pas convenir dans un autre.

Je me contente d'établir le principe que la caisse d'une voiture d'enlèvement doit être en tôle galvanisée, construite de façon à pouvoir être chargée et déchargée aisément; je pense aussi que le déchargement doit se faire de préférence en basculant la caisse de la voiture ou en ouvrant le fond de celle-ci. Il faut enfin que ces voitures soient pourvues de couvercles dont un homme puisse aisément faire seul la manœuvre. Elles doivent d'ailleurs pouvoir être facilement nettoyées, leur nettoyage devant obligatoirement être fait chaque jour.

Quant à la traction, elle doit, à mon avis, être mécanique, seul mode qui permette d'enlever à la fois un gros volume d'ordures et de les transporter au loin avec rapidité.

Il existe des endroits où les voitures sont construites de telle sorte que la caisse peut être aisément enlevée du train de la voiture et déposée sur un truc de chemin de fer pour être transportée au loin.

Mais quand il s'agit d'enlever les boîtes ou récipients en même temps que les ordures, il faut naturellement que les voitures soient construites d'une façon appropriée à ce mode d'enlèvement, sur les avantages duquel je ne saurais trop insister; car il est à tous les points de vue bien supérieur à l'enlèvement par déversement, aussi bien en ce qui concerne la sauvegarde de la santé publique qu'au point de vue de la rapidité des opérations.

Je rappele enfin qu'il y aurait intérêt à ce que les ouvriers de l'enlèvement aillent chercher les récipients à l'intérieur même des immeubles pour éviter que ces récipients pleins d'ordures ne soient déposés sur la voie publique en attendant le passage des véhicules.

III. Emploi, Transformation ou Destruction des Ordures Ménagères.

J'ai dit que la question des ordures ménagères comporte trois temps: 1° la collecte dans la maison; 2° l'enlèvement ou l'évacuation des ordures hors de la maison et leur transport à destination; 3° l'utilisation, la transformation ou la destruction.

Que faire des ordures ménagères, une fois qu'on les a enlevées?

La question comporte trois réponses: l'on peut les utiliser dans leur état actuel, les transformer ou bien les détruire.

En ce qui concerne l'utilisation, il est, en bien des endroits, encore d'usage de transporter les ordures en dehors des agglomérations et de les livrer aux agriculteurs qui les utilisent comme engrais.

Mais les ordures telles qu'elles sortent des maisons étant mélangées à une foule de matières inertes plutôt nuisibles, l'on a imaginé, depuis quelque temps, de faire mécaniquement la séparation ou la transformation des ordures. Des usines ont été construites à cet effet: l'on y transporte les ordures et l'on en sépare immédiatement les objets métalliques, les débris de vaisselle, etc.; le reste est passé dans des broyeurs d'où sortent, d'une part, une matière ayant toutes les apparences du terreau et que l'on vend à l'agriculture, et, d'autre part, les papiers et les chiffons qui, ne pouvant se réduire, doivent être détruits dans un four d'incinération.

L'on a également proposé de transformer les ordures en briquettes pouvant servir au chauffage. A cet effet l'on y ajoute un peu de poussière de charbon et un agglutinant.

En certains endroits, l'on traite les gadoues par la vapeur: ces gadoues, préalablement triées, sont introduites dans les cylindres et soumises à l'action de la vapeur à haute pression. Après quoi, la matière est passée sous des presses, séchée, puis broyée, mise en sacs et vendue à l'agriculture, ainsi d'ailleurs que le liquide extrait.

L'on peut enfin procéder à la destruction des ordures ménagères au moyen de leur incinération totale. C'est là, à mon avis, le procédé le plus rationnel pour sauvegarder la santé publique. En France on l'emploie notamment à Rouen et au Hâvre. A Paris même, les mesures nécessaires sont prises pour pouvoir, en cas de besoin, incinérer la totalité des ordures ménagères de la ville.

En dehors des procédés indiqués ci-dessus, il existe de nombreux autres moyens pour se débarrasser des ordures, mais ils sont tous plus ou moins préjudiciables aux cités qui les emploient. Ainsi, dans certaines villes, on transporte les ordures directement dans un cours d'eau ou dans la mer. Ce procédé a le grave inconvénient d'obstruer le cours d'eau et, quand il s'agit du déversement dans la mer, de ne pouvoir être utilisé pendant le mauvais temps. D'autre part les parties légères des ordures sont renvoyées à chaque marée, enfin les filets des pêcheurs sont fréquemment abîmés par certains débris.

En d'autres endroits l'on transporte les ordures, depuis de nombreuses générations, à une certaine distance de la ville, où on les laisse pourrir librement, au grand détriment de la santé publique.

Paris.—A Paris, où il s'agit d'enlever et de transformer environ 2,000 tonnes par jour, soit près de 800.000 tonnes par an, le problème des gadoues prend une énorme importance. On n'a pas à s'y préoccuper, comme dans beaucoup de grandes villes, de la nécessité d'enlever les résidus de la voie publique, le balayage se faisant de telle sorte que tous ces résidus sont poussés directement dans l'égout. Il n'est donc question à Paris que d'ordures ménagères auto-comburantes qui sont susceptibles de produire une certaine force motrice.

Le programme se résout de la manière suivante: l'enlèvement doit se faire, à très bref délaí, au moyen de camions automobiles pouvant enlever 12 mètres cubes de gadoues et les transporter rapidement à l'usine la plus rapprochée.

Des usines construites autour de Paris, doivent faire le broyage des ordures ménagères et la séparation des chiffons et des papiers qui ne sont pas susceptibles d'être transformés par les machines. Après le broyage les ordures passent par un cylindre tamiseur qui rejette, d'une part, une matière ressemblant à du terreau et expulse, d'autre part, les papiers et les chiffons. Le terreau est expédié à la culture et les papiers et chiffons doivent être brûlés. Toutefois, en prévision d'une grave épidémie, les usines sont construites de telle sorte que toutes les ordures ménagères de la ville de Paris pourraient être incinérées.

La chaleur produite par l'incinération des parties légères sera utilisée à la production de la vapeur nécessaire pour actionner des dynamos qui serviront comme machines de secours pour aider à l'élévation des eaux et pour transporter au loin une partie des eaux usées de la ville.

Quant aux camions automobiles, dont il a été question plus haut, ils sont entièrement en tôle, leur longueur totale est de 6 mètres et leur largeur de 2 mètres. Le cube total est de 12 mètres, représentant un poids de 4,000 à 5,500 kilogrammes de gadoues. Ces camions sont destinés à accomplir un parcours quotidien d'environ 35 kilomètres pour chaque voiture, sur lesquels 7 kilomètres au moins pour la collecte durant laquelle la vitesse est très limitée, avec arrêt devant chaque immeuble. La caisse du camion s'ouvre et se ferme au moyen de portes en forme de dôme à glissières. La voiture peut virer entièrement sur 12 mètres seulement et cela, grâçe à un dispositif de direction électrique. La collecte terminée, le camion se rend à une usine d'incinération où il est amené sur une fosse et vidé par le fond. Le poids du camion à vide est de 5,750 kilogrammes.

Le programme de la ville de Paris, où une lutte intense est entreprise contre la mortalité, est de faire l'enlèvement des ordures ménagères pendant la nuit et de faire prendre les récipients d'immeubles à l'intérieur par les employés du service d'enlèvement.

De tout ce qui précède l'on peut conclure que si, à Paris, les moyens employés ne sont pas absolument parfaits pour la collecte, l'enlèvement et le traitement ou l'emploi des ordures ménagères, ils donnent néanmoins en grande partie satisfaction aux exigences de la santé publique.

L'enlèvement coûte à Paris 3 fr. 018 par mètre cube, y compris une part proportionnelle des dépenses générales du service de la voie publique.

Les recettes faites par la ville au moyen de la taxe des ordures ménagères se montent à 5.879,571 fr. par an.

Il y a 30 ans encore les cultivateurs des environs payaient un droit à la ville de Paris pour pouvoir enlever les ordures. Aujourd'hui c'est la ville qui paie pour cet enlèvement les sommes considérables que nous avons mentionées plus haut et qui vont sans cesse en augmentant. Mais les administrateurs et les édiles de la capitale. avant tout soucieux d'améliorer de plus en plus les conditions sanitaires, qui sont d'ailleurs très bonnes, ne reculent pas devant les dépenses quand il s'agit de la santé publique. Si l'on a tardé à adopter le service qui fonctionne actuellement et qui se complète de jour en jour, c'est qu'il a fallu procéder au préalable à de longues études et à de nombreux essais. L'on aurait sans doute pu rendre encore plus parfait le mode d'enlèvement en adoptant le système des boîtes fermées hermétiquement et transportées des immeubles aux usines pour y être vidées, mais le poids considérable à transporter journellement et la nécessité de manipuler des centaines de milliers de boîtes ont fait reculer les ingénieurs de la ville de Paris qui ont préféré le système de déversement dans les camions automobiles que j'ai décrits et dont les caisses étant toujours tenues fermées, pendant la marche, ne laisseront pas échapper de poussières, ne donneront pas accès aux mouches et ne choqueront aucunement la vue.

SYSTÈMES EMPLOYÉS DANS CERTAINES AUTRES VILLES.

J'ai constaté personnellement dans deux grandes villes de France, Le Hâvre et Rouen, des procédés qu'il me paraît intéressant de signaler.

Le Hâvre.--Dans cette ville maritime, très connue par son commerce, qui compte 136,159 habitants et où le nombre des maisons est de 11,251, la quantité des ordures ménagères à enlever est en moyenne de 80 tonnes par jour et de 30,000 tonnes par an.

La totalité de ces ordures est incinérée; à cet effet l'on a construit une usine comportant trois groupes de fours complets, chaque groupe comprenant trois fours d'incinération, une chambre de combustion des gaz et une chaudière à vapeur. La vapeur produite sert à actionner des pompes pour enlever les eaux de l'égout collecteur á marée haute et les conduire à la mer; on l'utilise aussi pour l'éclairage et toute la force motrice nécessaire dans l'usine, y compris celle que nécessite la fabrication de briques et de carreaux faits avec les résidus broyés des fours. La capacité d'incinération par groupe de fours est de 50 tonnes par 24 heures.

L'enlèvement des ordures ménagères, qui se faisait autrefois avec des tombereaux ordinaires, est assuré aujourd'hui par 19 voitures automotrices et 17 voitures de remorque. Le poids d'une voiture automotrice est de 5 tonnes; celui des remorques est de 3 tonnes. Le cube total d'une voiture est de 13 mètres, mais le chargement ne se fait généralement qu'à 6 mètres cubes. Un mécanisme ingénieux ou indicateur de poids, appliqué aux caisses des voitures indique le poids du chargement et permet ainsi un contrôle exact des ordures transportées. Le poids spécifique des ordures est d'environ 500 à 600 kilogrammes par mètre cube, selon la saison. Les voitures sont construites de telle sorte que la partie supérieure qui est en tôle, avec portes à coulisse, et qui doit renfermer les ordures peut se basculer aisément de façon à précipiter les ordures dans la fosse à proximité des fours d'incinération.

Au Hâvre il n'existe pas de récipients collectifs d'immeubles. Chaque locataire dépose sa boîte directement sur le trottoir où le service d'enlèvement vient la prendre pour la vider dans la voiture. Ces boîtes de ménage sont en tôle galvanisée: elles ont généralement la forme d'un seau et sont toutes munies d'un couvercle attaché à l'anse; c'est sans la moindre difficulté que le vidage des boîtes se fait et que le couvercle se remet sur le seau. L'enlèvement se fait sur la voie publique, de 6 h. 45 à 10 h. du matin en été, et de 7 h. 30 à 11 h. du matin en hiver.

Rouen.—Cette ville, qui est depuis longtemps renommée pour son industrie et la beauté de ses monuments, a environ 125,000 habitants se divisant en 40,541 ménages et habitant 17,081 immeubles.

Le poids spécifique des ordures ménagères est d'environ 400 à 500 kilogrammes par mètre cube, selon la saison, et la quantité à enlever est en moyenne de 150 mètres cubes par jour. L'enlèvement, qui se faisait autrefois au moyen de 52 tombereaux, est assuré aujourd'hui par 7 voitures automobiles et 50 voitures à bras appelées cabrouets.

Dans cette ville les récipients collectifs n'existent que dans les immeubles contenant au moins 25 ménages. Ces récipients d'immeubles sont fournis par l'administration municipale. Dans les autres immeubles on ne fait usage que de la boîte de ménage.

L'enlèvement général a lieu de 7 h. 30 à 11 h. du matin; il se fait au moyen de bennes, de la capacité d'un demi mètre cube, que l'on fait passer devant les maisons sur les cabrouets pour y déverser les ordures. Une fois pleines, les bennes sont fermées hermétiquement par des couvercles et transportées à un dépôt déterminé où les voitures automobiles vont les prendre.

Ces voitures sont des plus intéressantes et très ingénieusement construites. Le moteur actionne un mécanisme d'enlèvement et de descente des bennes; chaque voiture peut emporter huit de ces bennes. Une fois chargée, la voiture file vers l'usine où le moteur fait descendre successivement les huit bennes. Ceci fait, la voiture qui est pourvue, sous la plate-forme, d'un réservoir de 2,400 litres, passe sous un réservoir de même capacité qui remplit pour ainsi dire instantanément celui de la voiture. Celle-ci sort ensuite de l'usine et fait l'arrosage sur son parcours, après quoi elle va rechercher huit autres bennes pleines et continue ainsi la manœuvre.

L'usine d'incinération est construite à une extrémité de la ville, sur le bord de la Seine. Cette usine comprend trois groupes de quatre fours, du même système que les fours du Hâvre. Attenant à chaque groupe de fours se trouve une chambre de combustion après laquelle est la chaudière.

Le chargement des fours se fait par le haut, au moyen de grands entonnoirs appropriés, posés sur le sommet des fours. Des rails posés en élévation et auxquels on accroche les bennes permettent de diriger aisément celles-ci au dessus des fours. En déclenchant le couvercle, les ordures tombent dans l'entonnoir et glissent ensuite dans le four. Il existe naturellement un système d'obturation de façon à éviter la sortie des flammes par les entonnoirs.

La chaleur récupérée doit produire 1 kilogramme de vapeur par kilogramme d'ordures; le résultat obtenu dépasse les prévisions.

L'usine n'étant pas entièrement terminée ne donne pas encore son plein effet, mais on a la certitude de pouvoir compter sur 300 chevaux-vapeur au moins. Comme machines motrices, il y a des turbines à vapeur actionnant des dynamos qui fournissent le courant électrique nécessaire pour élever l'eau de la Seine, pour l'éclairage de l'usine aussi bien que pour la manœuvre des machines de l'usine en général.

Je crois devoir ajouter qu'au Hâvre aussi bien qu'à Rouen l'on constate que tout a été fait par des hommes rompus aux affaires, qui ont volu rester maîtres de la situation et qui sont en effet maîtres chez eux. L'organisation et les installations sont pratiques et économiques. Ils ont, dans les deux villes, solutionné l'éternelle question des ordures ménagères de la façon la plus catégorique, qui ne gêne personne et qui donne entièrement satisfaction à la santé publique.

La Société de Médecine Publique et de Génie Sanitaire s'est occupée de la question des ordures ménagères à diverses reprises et notamment en 1909 et 1910 [2] donne le résultat des travaux de la commission spéciale qui, après 32 séances, a fourni des rapports sur chacune des questions soulevées par la question générale des ordures ménagères, avec des conclusions: 1° sur la collecte et l'enlèvement des ordures dans la maison; 2° sur la collecte et le transport; 3° sur l'utilisation, la transformation ou la destruction; 4° sur l'utilisation agricole.

En terminant ce travail dans lequel j'ai envisagé les conditions générales de la collecte, de l'enlèvement et du traitement des ordures ménagères, j'ai cru devoir me contenter de citer trois exemples en France: Rouen, le Hâvre et Paris, pour montrer comme conclusion qu'après bien des études sur ce qui se fait à l'étranger, on a solutionné la question selon le tempérament des villes et selon les besoins que l'on avait à satisfaire.

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[1] Voir Revue d'Hygiène, avril 1902. Masson et Cie., éditeurs à Paris.

[2] La Revue d'Hygiène du 20 août, 1910 (tome XXXII, N°. 8, pp. 856–883).

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THE TRAINING AND STATUS OF PUBLIC HEALTH OFFICERS IN THE UNITED KINGDOM.

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INTRODUCTION.

The fundamental doctrine that the state is responsible for the health of its citizens has never yet been fully recognized by any nation, but the truth of it is gradually making progress in the minds of the more enlightened individuals who have given thought to the subject. Every legislative act dealing with public health has been a step in this direction without being consciously recognized as such, and there can be no doubt that this doctrine will before long be universally recognized and acted upon.

The medical profession has always done its best to urge on the Government to legislate on matters which tend to improve the health of the community, though such action is directly inimical to their own financial interests and has resulted in a very considerable reduction in the average medical income. It seems inevitable that this process will continue, and that unless some alteration in the method of remuneration for medical service is made there are grounds to fear that the rewards will become too small to attract the most intellectual and well-educated men into the ranks of the profession.

Looking back upon the history of medicine, we have seen a great change operating. To-day we recognize it to be vastly more important for the community that we should prevent disease than that we should cure it in the individual. This is the age of preventive medicine. Although drugs are helpful to the individual in that they may lessen his suffering and hasten his recovery they are of no avail in preventing disease in a population. Take the best established cures in medicine, the drugs known as specifics—iron in anemia, mercury in syphilis, quinine in malaria, antitoxin in diphtheria and tetanus—and who can say that they have exerted the slightest effect upon the incidence of these diseases in human communities? On the other hand, see what preventive medicine has accomplished in combating puerperal and surgical fevers, smallpox, malaria, yellow fever, rabies (in England it no longer occurs), Mediterranean fever, plague, and relapsing fever. It is certain that when legislation grapples effectively with that great scourge, tuberculosis, it will likewise be possible to lessen its ravages, if not actually to exterminate it. Many hundreds of thousands of lives throughout the world are now saved annually by preventive medicine.

In view of the great practical results which have been attained of recent years it has become increasingly important to educate our profession in matters pertaining to the prevention of disease. To still further advance our knowledge we must find means not only to further research but also to maintain national public health officers and to reward them adequately for the great and noble work which they do for the welfare of the community.

HISTORICAL.

Medical officers of health in the United Kingdom were first appointed under the Towns Improvement-Clauses Act (1847). The appointment was permissive and the officer was not necessarily a medical man. The Public Health Act (1848) required that the officer should be a qualified medical practitioner. The Metropolis Local-Government Act (1855) required every vestry and district board to appoint one or more medical officers of health. The Public Health Act (1872) required that every sanitary authority (outside London) should appoint a medical officer of health, and this Act was the immediate cause which led to the establishment of the diploma in public health—granted in the first instance by the University of Cambridge in the year 1875, and subsequently by other universities.

The establishment of this diploma (diploma in public health) marked an epoch in the history of hygiene in the United Kingdom, and it is therefore of interest to revert to the causes which led to its institution. After the passing of the Public Health Act (1872) it soon became apparent that special training would be of advantage to men seeking the post of medical officer of health, in that local authorities in search of such an officer would be placed in a more favorable position for making their choice if they had some assurance that the medical men applying for the posts were suitably trained. At first the medical officer of health was merely a local practitioner, and the local authorities (laymen) as likely as not placed unfit persons in this responsible position.

I am indebted to Dr. George D. Liveing, F. R. S., for many years professor of chemistry in the University of Cambridge (now Emeritus professor), for the following information regarding the establishment of the diploma in public health in Cambridge, he being one of the few survivors amongst those who took an active part in the work of drawing up the original scheme for the diploma in public health:

> We soon agreed that it was a difficulty which the university might solve by holding examinations and giving diplomas to qualified medical men who passed satisfactorily in the general principles of hygiene and showed their ability to apply them practically. The possession of such a diploma would be a safe guide to local authorities and would facilitate the speedy appointment of medical officers of health throughout the country.

Sir G. Paget and Dr. Liveing were appointed by the board of medical studies in the university to draft a detailed scheme, which they did in consultation with Sir E. Parkes, then at Netley, whose distinguished work in hygiene had set them thinking about a scheme for furthering public health administration in a practical manner. It had been the custom before this time to set some questions on general hygiene in the examination for medical degrees, and in either Dublin or Edinburgh they gave a form of testimonial to those who passed in this branch; but the testimonial was given merely for book-derived theoretical accomplishments.

> We felt that progress in sanitation depended on scientific investigation, and at the same time the usefulness of new discoveries depended very much on the skill of those who had to employ them.

It soon became apparent that facilities would have to be created for students desiring to study for the diploma in Cambridge, and thus out of somewhat makeshift beginnings have the conditions for the acquisition of knowledge in matters of public health been gradually improved in Cambridge and elsewhere in Great Britain.

Dr. Liveing states, all too modestly:

> In brief, Parkes was the moving spirit, public opinion assented to a reform of careless habits of insanitary character, and the university was able to supply, in at least a partial way, the education that had heretofore been lacking, and the medical profession were prepared to make use of it.

From this time the number of medical officers of health distributed over the country gradually increased. The Local Government Act (1888) gave power to county councils to appoint a medical officer of health if they thought fit, but the appointment was only made compulsory by the Housing and Town Planning Act, 1909. This Act gave security of tenure to county medical officers of health.

That the special training afforded to medical men who held the diploma in public health, was of importance to the public was gradually borne in upon Government, for since January, 1892 (vide Local Government Act, 1888), the medical officer of health of every urban or rural district of 50,000 inhabitants or over must have a diploma in public health or have served as medical officer of health prior to the passing of the act.

DUTIES OF MEDICAL OFFICERS OF HEALTH.

Before considering the education of the medical officer of health, it appears essential to consider what are the duties which he has to fulfill and the difficulties with which he has to contend. His duties are laid down in the Sanitary Officers' (outside London) Order, 1910, as follows (condensed):

He shall (1) inform himself regarding influences affecting the public health; (2) study the cause, origin, and distribution of disease and how to prevent it; (3) make systematic or periodic inspections and report thereon: (4) advise the council (of county, borough, or district) regarding health and sanitary matters, and issue certificates relating to these matters when required; (5) visit and make inquiries where epidemic disease breaks out, advise or take legal steps to limit the outbreak; (6) subject to the council, to superintend the work of the inspector of nuisances. and to take such legal steps as are required in accordance with the findings of the inspector; (7) where it is necessary, inspect food, and, if found unfit, bring the matter before justice; (8) perform duties imposed on him by by-laws and regulations of council; (9) inquire into offensive trades and report upon prevention of nuisance or injury to health thereby entailed; (10) attend at the office of the council as directed; (11) report periodically, in writing, to council upon his proceedings, upon sickness and mortality; (12) keep books recording his work and produce them when required by the council; (13) make weekly returns of notifications of infectious diseases to the Local Government Board, and send duplicate returns to medical officers of health about his district; (14) make an annual report to the council on sanitary circumstances, administration, and vital statistics of his district (for details, see the order); (15) report at once to the Local Government Board in the event of an outbreak of plague, cholera, smallpox, or other serious disease; (16) send copies of his annual report and of any special report to the Local Government Board and county council.

In a memorandum of the Local Government Board regarding the appointment of medical officers of health and inspectors of nuisances, dated December, 1910, besides other recommendations, to which I refer elsewhere, it is advised that small districts shall combine to secure the services of an efficient officer, or failing this, that sufficient work and remuneration be found for the local officer by allowing him to perform other duties such as school medical inspector (the Local Government Board and Board of Education have advocated such combined duties), or superintendent of the isolation hospital (the medical officer of health receives notifications and should be able to isolate cases without having to consult others), or certifying factory surgeon, appointed by the Home Office (the health officer and Local Government Board agree that these offices can be combined), or police surgeon, public vaccinator, district medical officer, medical officer to the workhouse. The medical officer of health, under such circumstances, may also be permitted to make bacteriological examinations of water and for diagnosis in disease, or may supplement his official income by acting as a consultant in cases of infectious diseases, or by teaching pupils in sanitary science.

It is desirable, as pointed out by the memorandum of the Local Government Board (1910), that the medical officer of health should not be a general practitioner. Since 1909 a medical officer of health to a county council has been debarred from practice. It is essential, in the latter case, that he should devote his whole time and energies to his official duties. The councils of nearly all the county boroughs and of many other large districts have appointed specially qualified men, who are not to engage in private practice. In the case of the district medical officer of health, the salary should be raised so that he need not fall back on practice to make a living. Besides, in the present state of his position his duties as medical officer of health may conflict with his private practice to a serious degree. It is clear from the foregoing that a wide range of knowledge is required of a medical officer of health, considerable powers of adaptation to his surroundings, and no small knowledge of how to deal with men. We may now turn to some of the difficulties with which he has to contend.

DIFFICULTIES WITH WHICH MEDICAL OFFICERS OF HEALTH HAVE TO CONTEND—THE LOCAL AUTHORITY.

"The sanitary officer is invested with hardly any statutory powers. His function is that of a reporter of insanitary conditions and an adviser as to the best means of remedying those conditions. The local authority can alone decide whether the remedy shall be applied." This is an abuse which should be remedied, for the medical officer of health is thereby often rendered powerless to insist upon essential reforms in the face of local opposition and ignorance. Clothed in temporary authority, frequently ignorant, as often as not financially interested, sanitary measures which are required are not carried out through the opposition of influential members belonging to a local authority. The influence of such bodies is baneful to the last degree to the progress of sanitary science and detrimental to the best interests of the public.

TENURE OF OFFICE.

As things stand at present, only a limited number of medical officers of health are secure in their tenure of office. Every metropolitan medical officer of health, county medical officer of health in

England and Scotland, and every poor-law medical officer have security of tenure and can only be dismissed from office with consent of the Local Government Board. A provincial medical officer of health has no security of tenure, the "Sanitary Officers' (outside London) Order, 1910," provides that he shall be appointed by the sanitary authority for one year and that the appointment may terminate upon three months' notice prior to the expiration of that year or of the year following. A county council may suspend an officer, but must report thereon to the Local Government Board, who may remove the suspension. Whereas the county official is only removable with the consent of the central authority, the district official is subject to capricious removal solely by his district authority. If there are valid reasons for the county medical officer of health being a permanent official, the reasons are still stronger in the case of the district medical officer of health. In the first instance the duties are "purely administrative and general, whereas those of the district officer are executive and particular. He it is who has to come to close grip with the local authority and with individuals, and in doing so he must of necessity come in conflict with private interests. Indeed, if there is one official more than another who should be protected in the carrying out of his duties it is the district medical officer of health." [1]

The author of the passage just quoted writes elsewhere:

> How can a medical officer elected from year to year report and condemn properties owned by influential citizens, possibly by the councilors who appoint him? Such action is constantly, under present conditions, creating difficulty and disaster. Earnestness in sanitary work is too often condemned as medical officiousness, and the energetic reformer has to make place at the next annual election for a more apathetic and less reforming successor. The public health suffers, the property is protected, and the rates saved in the present to be magnified in the future.[2]

Again, in a letter to me, dated this August (1912), he writes:

> Although the position of the (district) medical officer of health has somewhat improved since the latest Order of the Local Government Board (1910), periodical reelection no longer being required, he can, nevertheless, be dismissed at three months' notice without the sanitary authority alleging any reason, and in any case it is always easy to manufacture a reason for dismissal, such as that the medical officer of health has not been tactful or that he has failed to investigate an outbreak of disease with sufficient care, etc.

Whereas in large towns the medical officer of health is usually shielded by public opinion, this is not the case in rural districts.

It is certainly an anomaly that the local authority arrogates to itself the entire authority of the appointment of the medical officer of health whilst only paying one half of his official salary, the other half being supplied by the exchequer. This anomaly persists in spite of repeated recommendations advanced by royal commissioners, departmental committees, and other bodies, dating as far back as 1871.

The royal sanitary commission, upon whose recommendation the Local Government Board was established, reported to Parliament in 1871:

> In order that medical officers of health may be able to discharge their duties without fear of personal loss, they should not be removable by any local authority except with the sanction of the central authority.

A medical officer of health under the thumb of the local authority may not dare to report to the Local Government Board upon crying evils in his district. If he does he may be dismissed. One medical officer of health of many years' standing informed me that his local authority insists on editing his reports before they are sent on to the Local Government Board.[3] When he was younger in office he was on the verge of being dismissed by the local authority because he had dared to report directly to the central authority regarding a grave condition of affairs which, if ameliorated, would have run counter to the interests of certain members of his "sanitary" authority. The choice in such cases has frequently lain between submission on the part of the medical officer of health and losing his livelihood. One of the frequent difficulties arises from members of the sanitary authority being owners of insanitary houses; several such instances have come to my knowledge of recent years. Some of the most influential city fathers are owners of the worst slum property. (See also Public Health, 1902; Report of the Interdepartmental Committee on Physical Degeneration, 1904.) What I state is a matter of common knowledge. The insecurity of tenure is a grave injustice to a competent and active medical officer of health who desires to do his best for the community intrusted to his care. What use is his high standard of training if he is thwarted in his efforts and at the mercy of an interested clique? In his service there is no order of promotion, no pension system. It is astonishing to think that men of ability seek to enter such an ungrateful service, where they are constantly thwarted in their best endeavors and cut off from the advantages and cooperation existing in an organized service. Such conditions, in the words of Sir Clifford Allbutt, indeed incline the medical officer of health " to lose standards, to lose efficiency, to lose heart." Moreover, the constantly increasing scope of the duties of a medical officer of health only serve to accentuate the difficulties he has to encounter in the face of vested interests, for the more many-sided his activities the more numerous do the points of contact with resistant elements become.[4]

In view of the insecurity of tenure of medical officers of health in rural districts it appears imperative that steps should be taken to improve their position. This could be attained by placing them under the Local Government Board in the same way as the certifying factory surgeons are appointed by and under the Home Office. The treasury would then pay the whole salary of the medical officers of health; at present one-half comes from exchequer grants. The medical officers of health would then report direct to the Local Government Board, and would take appropriate steps to carry out the public-health acts in the same way that the factory inspector carries out the factory acts. A medical officer of health, writing to me, says:

> The absurdity of the present position is appreciated if you could imagine the factory inspectors being appointed by and liable to dismissal by manufacturers.

If manufacturers controlled factory inspectors as many a medical officer of health is controlled by his health committee, do you suppose that they would allow many of the regulations for the protection of workmen to come into force? Certainly not, however needed, if they appeared to them to be expensive and troublesome.

It is essential that the medical officer of health should be free to act independently of local influences, in a disinterested manner, and solely for the good of the public. To make this possible it is necessary that his tenure of office shall be secure and not subject to possible inimical local authority. His appointment should rest secure in the hands of a central authority, and he should possess statutory powers in the carrying out of which he should be able to rely upon the support of a central authority.

COORDINATION OF PUBLIC HEALTH SERVICES NEEDED.

The general public health service of the United Kingdom is in a chaotic condition owing to the appointments made in the various supplementary services being in the hands of different administrative bodies working independently of one another. The different authorities do not properly control and regulate their officials and there is much effort wasted owing to lack of coordination. In consequence it is frequently necessary to disentangle much red tape before it is possible to carry out the simplest measures. The need of organization is felt in all the medical services outside the army, the navy, and the Indian army, where models may be found upon which to organize the multiplicity of public health services under a single civil medical service.

The Local Government Board appoints the medical officers of health, inspectors of nuisances, poor-law medical officers, and public vaccinators; the Home Office appoints the factory inspectors; the Board of Education appoints the medical inspectors of schools; the Board of Trade appoints ships' doctors; the municipalities appoint doctors for fever hospitals; the prison commissioners appoint prison surgeons; the lunacy commissioners appoint (through the county councils) the asylum doctors; the Colonial Office appoints colonial medical officers; midwives are certified by the central midwives' board and controlled by the county council or the local authority; and matters pertaining to veterinary medicine fall under the Board of Agriculture and Fisheries.

There are serious grounds for fear that our existing system of voluntary hospitals, which has done splendid work in the past, will prove inadequate to deal with the increased work which will be required under the new insurance act, the operation of which has already seriously diminished the voluntary subscriptions upon which the hospitals are absolutely dependent for their income. In the light of our present knowledge it appears reasonable to suppose that many, if not all, of these institutions will have to receive State aid, and when this occurs a measure of State regulation of the hospitals will necessarily follow.

TRAINING OF MEDICAL OFFICER OF HEALTH.

The training of the medical officer of health may commence immediately after he has become qualified for practice. It is of advantage that the training should commence early, when the mind is receptive, and it is always desirable that subsequent work should be based on the broad and essential principles of the science which a man chooses for his life's work, although the detail may be forgotten in the lapse of years. The training for the diploma in public health[5] now required of those who desire to become medical officers of health in the United Kingdom lasts for a period of nine calendar months. The first part of the training, lasting four months, is concerned with the principles of sanitary science—the study of chemical and physical methods required in their application to public health problems, air, water, soil, sewage; food, climatology, bacteriology, parasitology, and the general pathology of diseases of animals transmissible to man, etc. Candidates are examined after they have completed this part of their training. The student must pursue his course of training in certain institutions recognized as affording facilities for the adequate training of men for the diploma of public health. These institutions are independent of the examining body, but are subject to inspection by the bodies granting diplomas. The second part of the curriculum relates to municipal and domestic hygiene, sanitary engineering, food inspection, epidemiology and the geographical distribution of disease, occupational hygiene, vital statistics, and public health laws. This part of the course may overlap to some extent with the first part. During six months out of the nine the student undergoes a course of practical training in public health administration under a medical officer of health possessing an adequate status. During three months out of the nine he must attend at a hospital for infectious diseases and acquire a knowledge of administrative methods there required.

DISCUSSION AND CONCLUSIONS.

Although a great deal has been accomplished in fitting men by special training for the public health service in the United Kingdom, the advantages of this training are largely wasted, owing to the unfavorable conditions under which the medical officer of health is placed. To raise the standard of training and to increase the effectiveness of the medical officer of health and other medical services a national board of health is required, under a minister of public health. The medical officer of health should be placed under a central authority (national board of health) and be able, in the exercise of his functions, to act freely without regard to local authority. The medical officer of health should have security of tenure in office, the prospect of promotion dependent upon ability, and a pension in view after a definite number of years of service, as in the army medical service. The medical officer of health should give his whole time to his work. Part-time appointments should be abolished, and districts in which such officers have hitherto been employed should be united until they become sufficiently large to fully engage a whole-time officer.

The Insurance Act, new legislation in relation to tuberculosis, and the medical inspection required in schools all demand the establishment of an increased medical staff under State control. To secure the best results it will be necessary to organize the public health service upon a sound basis. Assistant medical officers of health should receive an adequate salary (£250 per annum being the minimum), and to them should be apportioned definite spheres of work. To attract suitable men to the service, which is destined to become more crowded in the future, it will be absolutely necessary to assure them of promotion, and this might be obtained by examinations leading from grade to grade as in the Royal Army Medical Corps. In the absence of such promotion, in the absence of a pension after years of faithful service, in the absence of the stimulus of an esprit de corps, there will be no attraction in the service and no incentive to do good work.

At present the preliminary training leading to the diploma in public health lasts nine months; this is the minimum period needed for the acquisition of some of the knowledge required of a medical officer of health. The young officer has much to learn, however, after he has obtained his diploma. The public should benefit from the increased store of knowledge he acquires from year to year, and he, like a soldier, should be given a chance to rise in the ranks. At present what little promotion exists is governed by favor or by chance.

The examination for the diploma in public health should be a State examination, uniform in standard throughout the land. At present—and I speak from several years' experience as an examiner for the diploma in public health in Cambridge—it is notorious that the standard of the examination varies considerably in different universities. Our Cambridge diploma is specially prized because the examination is known to be more difficult than usual, and holders of our diploma are more likely than others to be chosen as medical officers of health by discerning bodies.[6]

In the diploma in public health examination, as in every examination, we have to deal with a large number of men who have been "artificially" inflated with temporary knowledge—the application of the examiner's pin prick often bursts the bubble. Professional crammers, who advertise in medical journals, spoon feed the candidates to repletion with information which they believe certain examiners with pet notions may require. I once met one of these crammers who told me he knew fairly well in advance the kind of questions my coexaminers, A, B, C, and myself, would ask. His statement has ever since stimulated me to try and set questions which would disappoint the gentleman's calculations. As Sir Clifford Allbutt (1908) once put it, "it is the capacity of swallow and regurgitation by which our examination candidates amaze us." If the examiner breaks through the veneer of cram he often falls into an abyss of ignorance. It is for this reason that we in Cambridge lay special stress upon practical work in the examination, for here the wiles of the crammer can more readily be defeated. The reading done by most candidates prior to the examination is frequently confined to a textbook or two. One of my colleagues suggests that it would be well if they were required to study official reports and to look up the recent literature in certain current journals. This may be asking too much, but something should be done to make it clear to students that cramming a textbook is not sufficient.

Under the present system a large number of men are appointed to position of medical officer of health soon after taking the diploma in public health and may have had little or no experience in private practice. A medical officer of large experience informs me that "a young man fresh from the schools almost at once gets himself into hot water. He will assert with confidence that typhoid fever can be diagnosed during the first week of the disease and express his indignation to his health committee if Dr. X. has failed to notify a case within that period. He has no idea of the difficulties the general practitioner has to contend with, and they on their own part have little or no confidence in him * * *." The best medical officer of health is one who has had 10 or 12 years' practice. If the medical officer of health is to do all that is expected of him he should be a senior man among his colleagues.

This appears to run counter to the wording of the text in the diploma of public health, to the effect that the holder thereof is "well qualified in respect to his knowledge and skill aforesaid to fulfill the duties of a medical officer of health."[7] We must recollect however, that the duties of medical officer of health have grown more complex since the diploma was instituted, and that the duties are destined to become still more complex in the future. Various gentlemen whom I have consulted, because of their experience, assert that after obtaining the diploma the young potential medical officer of health should seek to broaden the basis of his knowledge by practical work in the several departments with which the duties of a medical officer of health are concerned. Here, again, we see the necessity of a graded and well-organized service. Under such a service he might begin by serving for a period as sanitary inspector and then as assistant medical officer of health, working systematically in different departments, always, however, as a whole-time officer, with graded rank and salary, and finally become eligible as medical officer of health. The latter should in turn be promoted according to merit and ability. Throughout his career the medical officer of health should be granted study leave at stated periods so that he may improve his knowledge elsewhere, for his training largely depends upon himself, and a wise administration should give the medical officer of health every opportunity of widening his horizon.

Appendix.

(A) EXAMINATION IN SANITARY SCIENCE IN CAMBRIDGE.

The following are the conditions under which candidates may apply for admission to the (biennial) examination for the diploma in public health in the University of Cambridge:[8]

1. The candidate must possess a registered qualification (British) in medicine, surgery, and midwifery.
2. He must present evidence of having undergone adequate training in sanitary science.
3. He must pass a satisfactory written, oral, and practical examination.

The examination consists of two parts which may be taken separately, but the result is not published until both parts have been passed. The following extract from the regulations schedules in broad lines the subjects in which instruction of candidates is required:

The first part of the examination refers to the general principles of sanitary science, and comprises the following subjects:

The elements of chemistry and physics: Methods of chemical analysis, and in particular the analysis of foods, air, water, and sewage. The laws of heat and the elements of pneumatics, hydrostatics, and hydraulics, in their application to warming, ventilation, water supply, and drainage. The geological and other conditions determining the healthiness of sites for dwellings. Sources, storage, and purification of water supply. The elements of meteorology in relation to health. The effects on health of season and climate. The general principles and chemistry of sewage disposal. Disinfectants, their chemistry and use. The microscopical examination of foods, and the detection of the commoner forms of contamination. Effects on health of overcrowding, vitiated air, impure water, polluted soils, and bad or insufficient food. The methods of bacteriological investigation and analysis. The bacteriology of air, water, food, and soil (protozoal diseases and animal parasites). The general pathology of infection and of the diseases of animals that are transmissible to man.

The second part of the examination refers to State medicine and to the applications of pathology and sanitary science, and comprises the following subjects:

Laws and Statutes relating to public health.[a] The model by-laws of the Local Government Board. Sanitation of dwellings, schools, factories, and workshops, and of villages and towns. School hygiene. Inspection of slaughter houses, cow sheds, etc. Inspection of meat and other articles of food. Principles of building construction in their application to dwellings, hospitals, and schools. The general principles and practice of sanitary engineering. General epidemiology, with special reference to the origin, pathology, symptoms, propagation, geographical distribution, and prevention of the epidemic, endemic, and other infective diseases both of temperate and of tropical climates. The methods applicable to the medical investigation of epidemics. Unwholesome trades and occupations, and the diseases to which they give rise. Nuisances injurious or dangerous to health. The principles and methods of vital statistics in relation to public health.

N. B.—The foregoing schedule is not to be understood as limiting the scope of the examination, which will include every branch of sanitary science. No candidate will be approved by the examiners who does not show a high proficiency in all the branches of study, scientific and practical, which bear upon the duties of medical officers of health.

PART I.

Before admission to the examination the candidate must produce satisfactory evidence that, after obtaining a registrable qualification, he has received adequate practical instruction in chemistry, bacteriology, and the pathology of the diseases of animals transmissible to man. The State medicine syndicate of the University of Cambridge recognizes only a limited number of institutions as giving adequate facilities for training men desiring to pass the examination.

In the United Kingdom there are 37 institutions recognized to-day as places of instruction by the syndicate, whereas only 3 institutions are recognized abroad (Hongkong, Cairo, Gibraltar).

The institutions whose courses of instruction are recognized by the syndicate are subject to inspection by members of the syndicate or others appointed for the purpose. It has been determined more recently that the course of laboratory instruction shall cover a period of not less than 4 calendar months and that the candidate shall produce evidence that he has worked in the laboratory at least 240 hours, of which not more than one-half shall be devoted to practical chemistry. The laboratory course should be so arranged as to lay special stress on work bearing on that with which the medical officer of health is concerned.

PART II.

Before admission to Part II his course for the diploma has extended over a period of not less than 9 calendar months, and he must produce satisfactory evidence—

(1) Either (i) that, after obtaining a registrable qualification, he has during 6 months [10] been diligently engaged in acquiring a practical knowledge of the duties, routine and special, of public-health administration under the personal supervision of—

(*a*) In England and Wales, the medical officer of health of a county or of a single or combined sanitary district having a population of not less than 50,000 or a medical officer of health devoting his whole time to public-health work; or—

(*b*) In Scotland, a medical officer of health of a county or counties or of one or more districts having a population of not less than 30,000; or—

(*c*) In Ireland, a medical superintendent officer of health of a district or districts having a population of not less than 30,000; or—

(*d*) In the British Dominions outside the United Kingdom, a medical officer of health of a sanitary district having a population of not less than 30,000 who himself holds a registrable diploma in public health; or—

(*e*) A medical officer of health who is also a teacher in the department of public health of a recognized medical school; or—

(*f*) A sanitary staff officer of the Royal Army Medical Corps having charge of an army corps, district, command, or division, recognized for this purpose by the general medical council; [11] or—

(*g*) An assistant medical officer of health of a county or of a single sanitary district having a population of not less than 50,000, provided the medical officer of health of the county or district in question permits the assistant officer to give the necessary instruction and issue certificates.

Or (2) that he has himself held, for a period of not less than three years, an appointment as medical officer of health of a sanitary district within the British Dominions, and having a population of not less than 15,000.

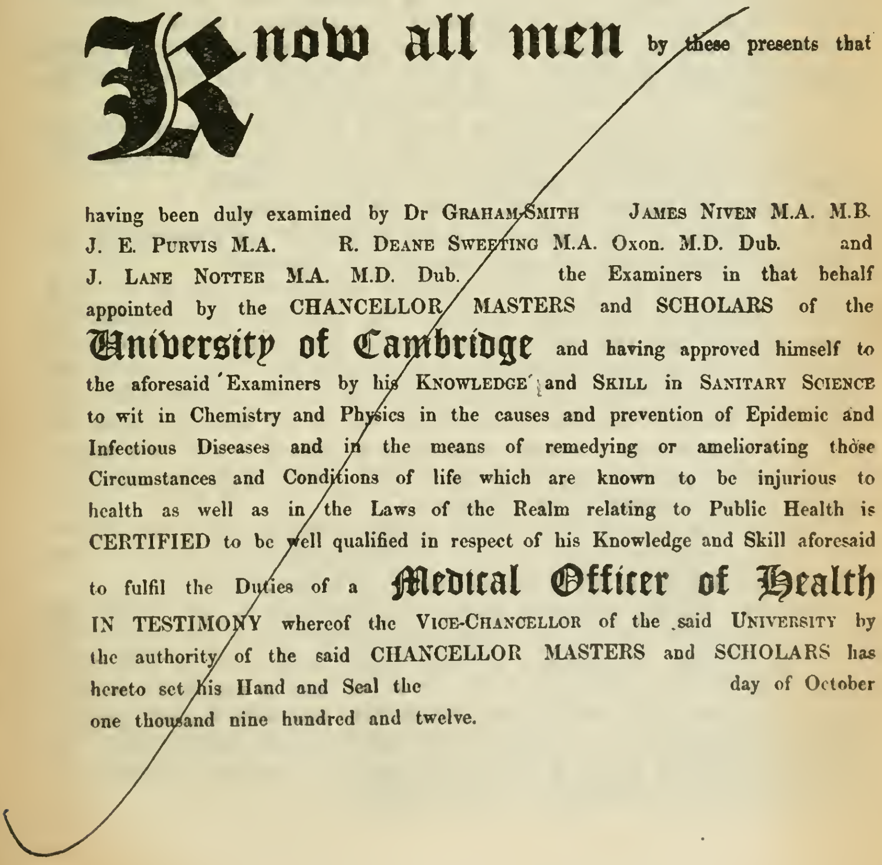
And (II) that, after obtaining a registrable qualification, he has during three months attended at least twice weekly the practice of a hospital for infectious diseases, at which he has received instruction in the methods of administration.[12]

The certificate of an assistant officer of health of a county or of a single sanitary district having a population of not less than 50,000 may be accepted as evidence under paragraph (II), provided the medical officer of health of the county or district in question permits the assistant officer to give the necessary instruction and to issue certificates.

The certificate for the purpose of rule governing part II, (1) (i) must include testimony that the candidate has attended under the supervision of the person certifying on not less than 60 working days.

COST OF TRAINING.

In Cambridge, all the courses required by the candidate training for the examination can be obtained at a cost of £30 9s. if he is not a member of the university, but if a member the cost is reckoned at £26 5s. There are seven courses given: (i) General course of lectures on hygiene, (ii) chemistry and physics (lectures and practical work during two terms), (iii–iv) bacteriology, protozoology, animal parasites, and preventive medicine (lectures and practical work during one term), (v) lectures on sanitary law, vital statistics, etc., (vi) practical sanitary administration, (vii) infectious diseases hospital. These seven courses are given by as many teachers. Admission to both parts of the examination costs the candidate £12, including the diploma.



Know all men by these presents that

having been duly examined by Dr Graham-Smith James Niven M.A. M.B. J. E. Purvis M.A. R. Deane Sweeting M.A. Oxon. M.D. Dub. and J. Lane Notter M.A. M.D. Dub. the Examiners in that behalf appointed by the CHANCELLOR MASTERS and SCHOLARS of the University of Cambridge and having approved himself to the aforesaid Examiners by his Knowledge and Skill in Sanitary Science to wit in Chemistry and Physics in the causes and prevention of Epidemic and Infectious Diseases and in the means of remedying or ameliorating those Circumstances and Conditions of life which are known to be injurious to health as well as in the Laws of the Realm relating to Public Health is CERTIFIED to be well qualified in respect of his Knowledge and Skill aforesaid to fulfil the Duties of a Medical Officer of Health

IN TESTIMONY whereof the Vice-Chancellor of the said University by the authority of the said CHANCELLOR MASTERS and SCHOLARS has hereto set his Hand and Seal the day of October one thousand nine hundred and twelve.

(B) LIST OF UNIVERSITIES AND BOARDS GRANTING THE DIPLOMA IN PUBLIC HEALTH, OR DEGREES IN PUBLIC HEALTH.

UNIVERSITIES.

Aberdeen grants the diploma in public health. Graduates of other universities must attend certain public health courses in Aberdeen prior to admission to the examination.

Belfast: Queen's University grants the diploma in public health.

Birmingham grants (1) the diploma in public health to all who are registered under the medical act and have received instruction in Birmingham; (2) the B. Sc. degree in public health to its own medical graduates who pass a special examination having a higher standard than that for the diploma.

Bristol grants the diploma in public health and gives courses of instruction.

Cambridge grants the diploma in public health. (See particulars on p. ——.)

Dublin: University of Dublin grants the diploma in public health to registered medical practitioners; National University of Ireland has in view the granting of the diploma in public health and of a degree in public health.

Durham grants (1) the diploma in public health and (2) two degrees, bachelor of hygiene (B. Hy.) and doctor of hygiene (D. Hy.). The conditions for attaining the diploma in public health and B. Hy. are practically the same; B. Hy. candidates must be partly trained at Newcastle-on-Tyne. The D. Hy. is attainable two years after the B. Hy. by candidates who have engaged in public health administration or in research and who submit a thesis.

Edinburgh grants the degrees of B. Sc. and D. Sc. in public health to its own or other graduates in medicine. The D. Sc. is granted five years after the B. Sc. in public health, an examination and thesis being required.

Glasgow grants the degrees of B. Sc. and D. Sc. in public health to graduates in medicine matriculating in Glasgow for the year in which they appear for examination. Some of the training must take place in Glasgow.

Leeds grants the diploma in public health and gives courses.

Liverpool grants (1) the diploma in public health and (2) a degree (M. H.) in hygiene to those taking courses of instruction in Liverpool.

London grants the M. D. in State medicine to holders of the M. B., B. S. (London) degrees of two years' standing. The candidates must present certificates to show that they have pursued studies similar to those required of candidates for the diploma in public health examination. Under certain conditions candidates holding the degrees mentioned may be admitted after the expiration of but one year after qualification, viz, if (i) they have taken the M. B., B. S. with honors in forensic medicine and hygiene, or (ii) have carried out an approved piece of original work, or (iii) have had special experience approved for this purpose by the university.

The examination consists of two papers in State medicine, one paper in medicine, a practical examination of two days in public health subjects (q. v.) The viva voce examination is left to the discretion of the examiners.

Manchester: Victoria University grants (1) the diploma in public health and (2) a degree, the B. Sc., in public health, also certificates in (3) factory and (4) school hygiene. The diploma in public health examination is open to all holding a registrable qualification. The B. Sc. is open to graduates in medicine (of Manchester and certain other universities) who have studied approved subjects at Manchester for not less than two years after graduation and devote a third year to work in the scientific departments. Candidates proceeding to the degree must hold the diploma in public health.

Oxford grants the diploma in public health under conditions similar to those in Cambridge.

St. Andrews grants the diploma in public health as in Cambridge.

Sheffield grants the diploma in public health, but requires that part of the training be received at Sheffield.

ROYAL COLLEGES.

The conjoint board in England, examining on behalf of the Royal Colleges of Physicians and Surgeons, grants the diploma in public health. Candidates, before admission to Part II of the examination, must be aged at least 24 years.

The conjoint board in Ireland, examining on behalf of the Royal Colleges of Physicians and Surgeons, grants the diploma in public health.

The conjoint board in Scotland, examining on behalf of the Royal Colleges of Physicians and Surgeons, Edinburgh, and the Royal Faculty of Physicians and Surgeons, Glasgow, grants the diploma in public health to all holders of a registrable qualification of over one year's standing.

(c) TONING DOWN THE ANNUAL REPORT OF A MEDICAL OFFICER OF HEALTH.

[Extract from Public Health, Vol. XXV, p. 393, July, 1912.]

At the meeting of the Clay Cross urban district council on April 5 exception was taken to the annual report of the medical officer of health, Dr. Duncan.

The chairman stated that he proposed reading extracts from the annual report, and suggested that certain parts ought to be omitted, while the clerk (Mr. Alf. Slack) complained that the doctor was always "rapping" at the council in his reports to the Local Government Board, which was not at all fair.

The report stated that "there was a lack of open space about many of the houses. Off many of the streets are yards, a few of these with more than a 4-inch to 6-inch strip of porous brick around the back doors, while the principal ornament in the center of the yard is a large ash pit, with privies all around like a rabbit warren. In winter the place churns with mud, and the mud goes right into the houses on the boots and clothes of those who are out and in. In summer the surface, too often carrying garbage in varying stages of decay, makes an excellent ground for the germs presently carried as dust or by flies to the food in the houses and to the milk the children drink."

The Clerk (interposing). Is that a right thing to send to the Local Government Board?

The chairman continued reading the report, as follows: "The infant mortality for 1910 was 165, and for 1911, 184. The cost of paving the yard could hardly be 'more,' but the council declined to adopt the powers offered them under the public-health act, 1907."

Commenting on the part of the report advocating the compulsory paving of back yards, the clerk argued that the council had no power of compulsion in this respect, although the medical officer persisted in inserting it in his report year after year. "He is always having a rap at us," said the clerk, "and even if we did adopt the section of the act he refers to we could not compel owners to do the paving in yards used by several tenants."

Dealing with the infantile mortality returns, the report contains the following passage, which was also taken exception to: "The belief is prevalent that a child, particularly an ailing child, will be sustained by extra food, bacon, tomatoes, wine, beer, and other delicacies liked by the parents or believed in because of their costliness."

The chairman remarked on this: It is hardy dignified.

The CLERK. Do you think any other report will be received like that? We shall smell nice at London.

Subsequently the chairman asked, What are we going to do with the report? and

The clerk inquired, Has it to go as it is?

The chairman thought it ought to be "toned down" considerably before being sent to the Local Government Board. It did not reflect to the dignity of the council.

The CLERK. It certainly casts a reflection on the council.

Eventually it was agreed that the chairman and clerk interview the medical officer on the subject, with a request to him to tone down his report before it was sent to the Local Government Board.

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[1] British Med. Journ., 27, VIII, 1909.

[2] Brit. Med. Journ., 4, IV, 1908.

[3] A similar instance is cited in the Appendix (C) to this paper.

[4] The following note is extracted from a letter received by me from a medical officer of health of many years' standing. Whilst it recapitulates some of the remarks I have made, it may be taken as a typical expression of opinion such as I have heard frequently repeated by other medical officers of health of my acquaintance:

"*The administration of public health as seen in practice in an obscure country place.*—Within a 5-mile radius there are seven separate sanitary authorities with seven separate offices and officers. The aim of each authority is to keep the rates as low as possible, with which object in view they freely take advantage of the permissive nature of public-health legislation.

"For example: (*a*) The elementary duty of scavenging (which the local authority may, and not shall, undertake) devolves on the occupier, and its efficiency depends on the police supervision of the medical officer of health and the sanitary inspector. (*b*) Until made compulsory, the notification of infectious disease was opposed as 'doctor's fees.' (*c*) 'Housing of the working classes' legislation has been and is a dead letter, so far as any outlay by the authority is concerned.

"Under pressure of the Local Government Board and county council, for the last 20 years sewerage and water have been taken up one after the other (engineers have been engaged, schemes prepared, loans applied for) and then dropped. That such masterly inactivity is possible arises from the annual election of one-third of the members of the local authority. By the time a majority has worked out a definite policy an election is due and, with the advent of new members, the work begins de novo * * * (speaking of the medical officers of health). His position lies between the devil of being shot at if things go wrong and the deep sea of making things too hot for himself not only with the authority but with his patients, on whom he depends for a livelihood. On him has fallen the brunt of preaching the gospel that the preventable can and should be prevented, and he often has been a martyr to his faith. * * *

"He may expect no support from the Local Government Board, and from all the notice taken of his reports they might as well have never been sent. The local authority expects to edit his reports before they are sent to the Local Government Board, and failure to submit them would lead to friction, if not dismissal.

"The county medical officer of health was originally a specialist in public health, but with increasing legislation (midwives' act, medical examination of school children, and national insurance act) he is rapidly becoming a jack-of-all-trades, with more than he is properly equipped for or can attend to."

[5] See Appendix (A) and (B) for details.

[6] I have had a candidate in the examination at Cambridge ask me to let him know as soon as possible if he had passed because, expecting to fail, he desired to take the next available train to pass the diploma in public health examination elsewhere. Many men who fail with us succeed in several universities which I could name. A colleague who has likewise examined for the diploma in public health (Cambridge) draws my attention to the fact that "some papers set in other places are much too easy, although they apparently cover the ground of a difficult syllabus."

[7] See Appendix (A).

[8] For further particulars of the courses given in Cambridge apply to the secretary of the State Medicine Syndicate, Cambridge. Printed copies of the regulations and examination papers set at former examinations may be obtained at 1s. a set (by post 1s. 1d.) on application to Mr. C. F. Clay, manager, the Cambridge University Press Warehouse, Fetter Lane, London, E. C.

The regulations for the examination in sanitary science are subject to revision by the syndicate from time to time, with the approval of the Senate of the University and of the General Medical Council.

[9] All candidates will be examined in the provisions of the English Statutes relating to public health, but any candidate will be given an opportunity of showing a special knowledge of other sanitary laws in operation within the British Empire, provided that, when applying for admission to the examination, he give notice of his desire and indicate the special law he proposes to offer.

[10] The certificate for the purpose of this rule of the syndicate must include testimony that the candidate has attended under he supervision of he person certifying on not less than 60 working days.

Provided that if the candidate has—

(I) produced satisfactory evidence that he has attended a course or courses of instruction in sanitary law, vital statistics, epidemiology, school hygiene, and other subjects bearing on public health administration, given by a teacher or teachers in the department of public health of a recognized medical school; or

(II) produced evidence that he has been a resident medical officer in a hospital for infectious diseases containing not less than 100 beds, during a period of three months;—

the period during which he has been engaged in acquiring practical knowledge of his duties under this rule may be reduced to three months, to include an attendance on at least 30 working days.

[11] Districts recognized by the General Medical Council: Aldershot, Salisbury Plain, Southern and Southeastern, Western, Dublin and Belfast, Cork, Chatham and Woolwich, Home, Eastern, Northeastern and Northwestern, Scottish, Gibraltar Command. The following Indian divisions: First (Peshawar), second (Rawalpindi), third (Lahore), fourth (Quetta), fifth (Mhow), sixth (Poona), seventh (Meerut), eighth (Lucknow), ninth (Secunderabad), Burma.

[12] (1) Methods of administration shall include the methods of dealing with patients at their admission and discharge, as well as in the wards, and the medical superintendence of the hospital generally. (2) In the case of a medical officer of the Royal Army Medical Corps, a certificate from a principal medical officer under whom he has served, stating that he has during a period of at least three months been diligently engaged in acquiring a practical knowledge of hospital administration in relation to infectious diseases, may be accepted as evidence under Rule II (ii).

THE DEVELOPMENT OF EDUCATIONAL EFFORTS IN PUBLIC AND PERSONAL HYGIENE IN AMERICA.

Livingston Farrand, M. D., New York.

The general conditions which underlie this present widespread movement for the education of the public in the field of hygiene and preventable disease are entirely clear. They are obviously the result not only of the extraordinary advance in medical and sanitary knowledge which the last generation has witnessed, but of the revolution which has taken place in the attitude of the medical profession toward the public, and vice versa. We see a sharing of knowledge up to the point of public comprehension, and a replacing of mystery by confidence. While the present is a period of readjustment, the new relation is undoubtedly permanent, and the more or less intelligent participation of the public in the procurement of its own physical welfare is a fact. To make this participation as effective as may be is the object of public-health education.

In reviewing the movement in this country, two main lines of activity immediately present themselves. Undoubtedly, the first object, consciously desired, was the conveyance of the principles of a sound personal hygiene to the minds of the people. Here it is probable that much of the effort has missed its mark, but has, fortunately, achieved results of comparable value. It is beginning to be recognized that, to be effective, habits of sound personal hygiene and right living must be acquired in childhood. The man of fixed adult habits may see and understand, but he does not act. As a consequence, we see greater and greater emphasis being laid upon the teaching of the truths of health and sound living in the schools. Municipal boards of education are responding to the need. We find cooperation between State boards of health and of education resulting in measures of great importance to health education in the schools. There can not fail to be, in the coming generation, a familiarity with the facts of health and hygiene, and, it is to be hoped, a reaction thereto, that we, the parents, have not possessed as a part of our equipment for life and efficiency.

The second great aim of the educational effort was less fundamental, perhaps, but of immediate and pressing significance.

The application of scientific knowledge in any field obviously calls for expert administration. To my mind, the most important advance in recent years is the acceptance of the conclusion that the preservation of the public health is a public, and hence an official, responsibility. The health officer is the essential figure in the situation. It is not a field for the philanthropist or the amateur, but a condition which calls for efficiency based on technical training of the most rigid character. It demands a man or men of initial capacity, trained in medical and biological science, expert in sanitary engineering, and intimate with the conditions of housing and labor which underlie so many of our problems. Where we are to find him—or, rather, how we are to produce him—it is not my task to discuss. But having found him, and having placed upon his shoulders the heavy responsibility of safeguarding the public health by all the means known to modern science, one of the chief objects of public education becomes evident.

It is coming to be a common saying that public health is a purchasable commodity; that we can have such a degree of it as we are willing and able to pay for; and, within certain limits, the statement is true. Certainly it is clear that in any of our communities additional expenditures, accompanied by enforced sanitary regulations, will reduce not only the mortality but the morbidity in that community. Even now the difficulty is not the method, but the means.

In other words, the problem with which our enlightened health official finds himself face to face is to obtain the financial provision and the legal power to carry out the steps which he knows to be necessary. With our political organization such as it is, public support is naturally indispensable. It is here, then, that the second great aim of public-health education presents itself: To create an enlightened public opinion, an intelligent public sentiment which shall demand, authorize, and support an enlightened health administration.

If one were to select the most significant result of the educational movement of recent years, it would, in my opinion, be in that field. We are witnessing not only a restlessness on the part of the public, but an increasing readiness and, in certain rare instances, even an eagerness to make additional appropriations for health measures.

A word as to the methods by which these ends are being achieved. Organization is of course fundamental. Granted this, experience has shown certain avenues of especial value. First in order of development, but of decreasing relative value, is the public lecture. Always useful in direct proportion to the skill of the speaker, and still effective, it is becoming an adjunct rather than the central feature. Second, the exhibition, a method of more recent appearance, but one of proved effectiveness; a method, moreover, capable of infinite variety, and offering a field for ingenuity without limit. The latest addition is the use of the moving-picture device—at the present moment unique in its possibilities of reaching vast numbers of the population who will not listen, do not read, but will readily congregate and respond to the universal human love of action. And lastly, and undoubtedly most important, publicity by means of the printed page—not leaflets and reports, but the daily press and the weekly and monthly magazine, reaching a literally incalculable number of readers with a persistence of which they are unconscious. The cordial cooperation of the press of this country has been one of the most encouraging phases of the public-health campaign, and no other agency has equaled it in importance. While it is obvious that the press will always print in response to a public demand, much of this support has been deliberate, and based upon a clear realization of responsibility. Predictions of its temporary character have not been borne out, and even in the most actively worked field, that of tuberculosis, there has never been a time when the press has lent its aid more freely and effectively than to-day.

Barring the systematic instruction of the children of the Nation, this publicity, in its widest and best sense, is the education of the people. It is the indispensable preliminary of legislation and the necessary accompaniment of effective administrative control. It is here that many of our health administrations fail lamentably. It is doubtful if there is any department of our State and municipal governments whose aims and methods are less understood by the public than the department of health. It is apt to be viewed with suspicion and antagonism by physicians, and with apathy and neglect by the laity.

Particularly in smaller communities failure to act by the health authorities is explained by lack of public support. The fault is often, if not usually, that of the department itself. The public is not taken into its confidence, and we see on every hand the discouraging spectacle of the health officer plodding slowly behind, instead of leading and stimulating his local public opinion. An organized system of publicity should be in operation in every health office in the country. Wherever intelligently tried, whether in the greater cities or in towns of smaller population, the results are always worth while.

Certain comments may not be out of place in this connection, and perhaps the one most needed is a word of warning. There has been roused a wave of interest that is difficult to control. Enthusiasm is growing and is daily more easy to find, but enthusiasm is not always wisdom. Forecasts of results are freely made which may be theoretically possible, but are often practically little less than absurd. Pasteur's dictum as to the possibility of causing germ diseases to disappear from the world is not only accepted, but is embellished with a date at which that happy result shall have been achieved. Something of this is inevitable. It is seldom the fault of the leaders, but of overenthusiastic followers. It should be insisted upon, however, that the material of propaganda should be scrutinized with expert care. Demonstrable possibilities are sufficiently encouraging without appealing too much to the imagination, particularly when dealing with predictions as to the future.

Equally necessary are demonstrable facts in statements as to existing conditions. Millions are more impressive than hundreds, and the temptation to rouse a lethargic public by adding a guess to figures that will bear analysis seems sometimes too strong to be resisted. This is unnecessary and can only react to the hindrance of the general advance. The conditions, as they are, are sufficiently striking without overstepping the bounds of conservatism and certainty.

One other reflection may be permitted. It has been shown beyond dispute that, in order to obtain public attention and to impress truth upon the public mind, the attack must be specific and not general. Effectiveness is always lost in vagueness. And so we have seen the rise and development of the campaign against tuberculosis brought to a point where response is assured. The problem of infant mortality has its organization working for its solution along comparable lines. Sex hygiene and venereal disease are claiming attention and obtaining it. Mental hygiene has entered the field with a well-thought-out program and a definite plan of campaign. The inseparably connected social fields of housing, child labor, and the living and working conditions that underlie our own problem are being pushed, each by its own body of workers and thinkers, with an effectiveness that is producing a revolution in our society and our politics. This specialization was inevitable and necessary. The unavoidable bewilderment of the public mind is unfortunate, but becomes insignificant when compared with the results already in sight. But let us not forget that these activities are but phases of one great movement, which is best described under the term of public health. Let us not forget that, having initiated the action and directed the energy, coordination is not only desirable but a high responsibility. We have already reached the point where a closer union should be definitely planned and provided for. The exact method may not be clear, but the object is indisputable.

Such, in their broader outlines, are the functions of public-health education. To inculcate a sound personal hygiene; to demand and obtain efficient health administration; to produce an enlightened public opinion that will support official effort to put into practice the teachings of science and experience as they relate to the health and betterment of the people.

INSTRUCTION IN HYGIENE IN MEDICAL COLLEGES AND THE TRAINING OF HEALTH OFFICERS.

F. F. Wesbrook, M. D., Professor of Pathology and Bacteriology and Dean College of Medicine and Surgery, and Member and late Director Minnesota State Board of Health Laboratories.

In America we have been slow to recognize the need of special training for the various branches of public service. Many examples lie close at hand. We are proud to show visitors that our best and most-imposing buildings are for the training of our children, those who are to carry on the work after we have laid it down. Yet we intrust the training of our girls and boys to those who are school-teachers pro tempore, and the hope of each of these for ultimate graduation at the altar, at the bar, in the profession of medicine, or in business, being constantly in mind, is apt to lower pedagogic efficiency. Corporation lawyers often use the bench as a post-graduate training. The interests of the corporations demand and receive the services of the best and most highly paid talent; whilst, on the other hand, the interests of the public are too often left to the individual who needs the opportunity, either as a stepping stone to something higher or because he finds himself unfitted for the practice of law.

Our health offices are, from a mixture of motives, frequently given to the incoming recent graduate. It is freely admitted by the older practitioners that service as a health officer is likely to make the individual so unpopular that he will move on. The newcomer is therefore cajoled into the position. Frequently the older medical men have too much to lose from their private practices to be able to afford the questionable luxury of public service. Occasionally, too, the position of health officer, or of superintendent of a hospital or other institution, is regarded by the medical profession as a suitable gift for the man who has shown inaptitude or encountered misfortune in private practice. Too often the position of city engineer is given to the land surveyor or other individual who needs it, but whose original training and field of practice have not been such as to fit him for the care of this phase of the public interest.

On every hand, we seek, through volunteer agencies, to secure satisfactory administration of laws which should become operative through official mechanisms, thus possibly postponing the final solution of our difficulties. Thereby, we add tremendous burdens to those who volunteer for public service, and work them at great disadvantage, because frequently their main qualification is interest, rather than detailed knowledge.

However, we need not dwell on what has been. We can better discuss what is to be. Without delaying further to inquire into the mixture of causes, or pausing to fix the blame for the apathy of the public in regard to its own welfare, we recognize the need for radical reform. Here in America we, who are optimistically inclined, believe that the time has come when a demand is to be made in increasing degree for training specialists, who shall devote their whole time and energy to the various phases of public health protection. We must, however, adjust the pay, as well as the authority, of our health officials and workers to the responsibilities which the public expects them to assume. We must guarantee them tenure of office dependent alone upon efficiency. We must continue to insist that they be trained before they assume office, and not expect them to gain their experience at the expense of the public.

The present great wave of publicity can not but develop a public and private discrimination which will demand efficiency. Will the people who demand the efficient service be willing to pay the price for efficiency?

Altruistic and not financial considerations should dominate our discussion of the public welfare. It is useless, however, to expect men and women to spend thousands of dollars in preparation for their life's work, unless they may look forward to a fair return upon the invested capital. There is a yet more important investment of which we sometimes lose sight. I refer to the years of youth and enthusiasm which can not later be replenished as can an exhausted exchequer. On such a combined investment of the individual, it is but just that the public should make a return in recognition and the wherewithal to live.

What workers are needed in public-health fields is a question we must ask ourselves in attempting to provide for their training. The answer to this is that experts in every line who approach social and economic activities from the health standpoint are even now required. All of us are naturally solicitious about the future and desirous that better training be provided for our successors. Complexities in increasing degree are, however, inevitable, notwithstanding the rapid advance in man's knowledge concerning his own environment. This very advance demands greater specialization and therefore means increased difficulty of coordination. Furthermore, increase in density of population, and in facilities for transportation, very naturally increase our difficulties in the adjustment of the duties and responsibilities of individuals to each other, and of the individual to the mass.

In the ultimate analysis no official public health protective mechanism can operate without the intelligent interest as well as the sympathetic support of the medical profession, since its members are responsible for that individual and family health which, in the mass, represents public health. No attempt should be made, however, to create sanitary experts out of physicians by the ordinary medical college training. They should have sufficient foundation to enable them to meet their own responsibilities in general or special lines, and to articulate with the official health agencies.

No nation has more rapidly advanced in methods, machinery, and requirements for the teaching of medicine than has the United States, and the training now given to undergraduates in our best colleges is not excelled by that of any other country. A training of from six to eight years is required in college or university, medical school, and hospital in our leading institutions. This provides a general training in medicine, but does not constitute specialists in private practice, nor qualify the graduates as leaders in public medicine.

Engineering colleges, notably the Massachusetts Institute of Technology, are providing courses in sanitary and municipal engineering which require a four or five years' training, upon the completion of which graduates are incompetent to assume important and responsible public health positions without further training in relation to their "disease point of view." In our leading colleges and universities, in connection with the departments of economics and sociology, training is provided for social workers and others who have important public duties to perform. They need, however, some more definite ideas concerning structural problems and the engineer's viewpoint, as well as of basic biological, chemical, and physical principles, and modern conceptions and methods of dealing with health problems. The recently aroused interest in the study of municipal problems is important, if it does not leave out of consideration, or subordinate, State, Federal, and international relations, as well as that most urgent of our problems, namely, rural betterment, which has so many sanitary complications.

Doubtless the additional stimulus given to public interest in health protection by this Fifteenth International Congress on Hygiene and Demography will result in a public demand to compel by law that evidence of special training be furnished by applicants for public health positions, as has been the practice for some considerable time in Denmark, Germany, and Great Britain. Undoubtedly this demand will be met in America, just as the demand for better medical and better engineering teaching has.

Health departments of the future, and other official and volunteer agencies for promoting public health, must secure the coordinated service of various groups of physicians trained in many diverse lines; of economists; of social workers; of statisticians; of engineers of various trainings and ambitions; of dentists; hospital superintendents; bacteriologists; pathologists; chemists; meat, milk, and food inspectors; visiting nurses; school inspectors; physical trainers; inspectors of industries; teachers of public and personal hygiene; also, legislators, lawyers, and even policemen, must be impressed into the service.

How many of these workers require special training in advance in relation to their public duties? How should this training be provided, and who shall teach?

Universities with the necessary departments must cooperate with the various Federal, State, or municipal official and volunteer public-health agencies. The State universities of the Middle West can perhaps more easily make the needed articulations with other interests, and thus obtain opportunities for practical instruction, than the privately endowed institutions. If fortunate enough to be located like the University of Minnesota, in two progressive cities, the various phases of municipal hygiene may be studied practically and more efficient public health, practical, teaching " clinics " conducted.

In laying out a course for Minnesota the following agencies, amongst others, have been considered in plans for cooperative work, and should be expected to furnish teachers and opportunities for practical observation, with actual field work in the case of certain of them, because of their need of trained workers:

1. The University of Minnesota, a State institution.

(*a*) The colleges of medicine, dentistry, and pharmacy and the school for nurses must continue to graduate practitioners, train teachers, and become more productive in research.

(*b*) The college of agriculture, in relation to rural sanitary betterment, food production, and other such problems, has much in the way of opportunity and responsibility.

(*c*) The college of engineering, in matters involving construction and expenditure of funds, particularly in relation to water, wastes, ventilation, and building construction, should continue and extend its work in sanitation and public health.

(*d*) The school of chemistry should continue to participate in sanitary research and public-health teaching.

(*e*) The college of science, literature, and the arts, in its scientific laboratories of biology, physics, and psychology and in its departments of economics and sociology, is in a position to contribute and receive much of very real value.

(*f*) The college of education, particularly in medical-school inspection and the teaching of personal hygiene and physical training for children, has very real needs and offers unsurpassed opportunity for coordinating effort.

(*g*) The university department of physical training should be extended and built into a health promoting and teaching organization.

(*h*) The university health officer, when such a mechanism is provided, will furnish the much-needed means for public-health teaching and research in the discharge of his daily work.

(*i*) The university-extension bureau can undertake no more practical and important work than the training of experts in health publicity and the spread of the gospel of health.

(*j*) The college of law and other departments and mechanisms of the university can all help and be helped by such affiliations.

2. The State board of health, in its various branches, including administrative, engineering, epidemiological, statistical, and laboratory, is in need of trained workers, and should be glad to help in its many fields for practical training, because it thereby helps itself. Three of the four divisions are already housed by the State university, and cooperative arrangements should be still further extended. One of its division heads is on the university teaching staff in medicine and one in sanitary engineering. Both the engineering and the medical graduates are therefore better prepared to meet their public responsibilities and to be of real help to the State board of health and their own local health boards.

3. The State department of education, as also the city departments of education of St. Paul and Minneapolis, have many problems, educational and sanitary, which cooperative effort alone can solve.

4. The board of control institutions, which include State hospitals for the insane, schools for the feeble-minded, deaf, and blind; State institutions for tuberculosis; schools for dependent and neglected children; correctional institutions, etc., are increasingly embarrassed by lack of trained workers. They will increase the efficiency of their own staffs by the stimulus of having them assist in giving instruction.

5. That State live-stock sanitary board has many problems to solve and is helping to solve those which affect human health. It is already cooperating with the University Agricultural College.

6. The State dairy and food department, and the Federal Meat-Inspection Service at South St. Paul, are important instruments, not only in the protection of human welfare, but in the teaching of public sanitation.

7. The State attorney general's office can help in the study of the legal mechanism for the control of disease, and in the teaching of those who are to become expert in the use of legal and other tools for protecting health interests. The university should also prove useful to that arm of the State, if it could furnish medical and other scientific experts for the court work of the State and develop an institute of forensic medicine.

8. The State labor bureau has much both to give and to receive in such a combined effort.

9. The municipal health departments of Minneapolis and St. Paul, the city engineering departments in relation to water supplies and sewage disposal; the municipal hospitals for contagious and other diseases as well as the municipal health agencies of smaller cities, are important to the success of such an organization.

10. The associated charities organizations of Minneapolis and St. Paul need workers and can teach much.

11. The State association for the prevention and relief of tuberculosis and other voluntary organizations and agencies should all present their work and activities to the students of public health, and would undoubtedly welcome the advent of any mechanism for training workers.

The above list is one which has already been presented to the Minnesota State Sanitary Conference in 1910,[1] to which I have made some additions, and which should doubtless be extended still further.

Time does not permit of a detailed outline of such courses, but by interesting such agencies and workers as those mentioned, and by efficient instruction at our State university, and at certain stages of the teaching, by placing the students in the field with those actually engaged in the work, an ideal training could be provided.

In regard to the teachers, it is not enough that a single individual should give all the instruction. A lasting impression concerning the responsibilities involved in daily practice in a particular sanitary field can only be had from intimate contact with those who are specialists in that line. The different workers, factors, and fields involved should be presented to the student, so that he may realize more clearly what is expected of him in his private and public capacities.

Public health work constitutes a series, and it should be a coordinated series, of specialties. It therefore requires for its successful teaching a large staff, just as a large staff of medical teachers is required to teach modern medicine in all its phases. It seems probable that the development, even with those universities which are able to furnish the facilities already mentioned, and to secure the proper articulation, will be along the lines of, first, departments of public health, and, later, replacement of these by schools or colleges of public health having on their faculties many members of the staffs of other colleges in the university; and, in addition, lecturers from various State, municipal, and Federal departments, bureaus, and institutions, and also the officers and workers of voluntary associations and certain private institutions.

Little has been said about a curriculum, which must include the following, amongst other topics:

1. Legal mechanisms, Federal, State, and municipal, for the control of disease.
2. Vital statistics, or the bookkeeping of public health.
3. Consideration of the transmissible diseases and their means of spread and of prevention, whereby the nature of the virus or the microbe or exciting cause is considered; the atrium or gateway through which the virus gains entrance into the body; the distribution of the exciting cause in the infected individual; methods of its elimination; its point of exit; the rôle played by intermediate carriers or vehicles, and the modifications of procedure which are involved by our possession of any specific means of protection based on the use of vaccines, antitoxines, or other such agents.
4. Disinfection.
5. Occupational diseases, exclusive of infection.
6. Milk supply in relation to disease.
7. Food supply—meat inspection.
8. Water supply and sewage disposal.
9. Sanitary engineering and architecture, including plumbing, ventilation, hospital, school, and other public-building sanitation, as well as housing conditions.
10. Social economics and the economic cost of disease; saving to be effected through conservation; governmental and other life and sickness insurance mechanisms.
11. Publicity in relation to public health.
12. Sanitation of travel.
13. Sanitary aspects of embalming; funeral direction; transportation of the dead.
14. Inspection of hotels and restaurants in relation to cleanliness, sanitary facilities, and also medical inspection of those who handle food, water, etc.
15. School hygiene in its many phases.
16. The hygiene and the conduct of public institutions for the insane, feeble-minded, deaf, blind, and also our correctional institutions.
17. Eugenics in its educational and legal aspects.
18. Infant welfare.
19. The hygiene of venereal diseases.
20. Mental hygiene.
21. Naval and military hygiene.
22. Tropical medicine.
23. Personal hygiene, to include nutrition, instruction on food values and preparation, exercise, clothing, individual habits of work and sleep; sex hygiene.

24. Alcoholism in its personal and public phases.
25. Dental and oral prophylaxis should be considered, both in relation to personal hygiene and to public teaching and practice.

It is not practicable that the instruction given to the various types of public health workers should be identical in regard to the length of the course, the subjects included, or the amount and character of the instruction in each course. It is not necessary, or even desirable, that students should all have the same initial training. It seems fairly certain, in fact, that very different courses will be demanded, and it is therefore only logical that different degrees or diplomas should be granted according to the nature and the length of the training which has been received and the character of the public health service for which the individual seeks to qualify. For those who expect to serve as medical officers of health shall we demand a preliminary graduation in medicine? If so, shall we give a three years' training in the public health school? This question can be answered best by saying that thus far the American universities which have developed such courses have had practically no students. It is absolutely necessary that all workers in the public health field should acquire the "disease point of view," but it does not seem feasible or desirable that of every worker in public health a medical degree should be demanded. Physicians who go into public health work find that to their knowledge of medicine must be added many other important items of experience. Engineers are ready to make the same admissions about their deficiencies of training. Sociologists and economists have already found that it is impossible for one individual or department to specialize in every phase of human activity and relationship. They realize that, unless due care is exercised, they are likely to lack discrimination in relation to medical matters, just as the engineers accuse the medical men of being deficient in quantitative sense. We shall not arrive at our destination, however, if we stop when we have pointed out each other's faults. Only by team work, in which each recognizes the importance and strength as well as the deeds of his collaborators, shall we advance.

As an additional safeguard of our public health, if it seems desirable, we may require license of the trained worker, in addition to his diploma or certificate.

The additional duty might be put upon our State board of health of examining for license those who seek to enter any of the sanitary fields for which they have received special training, as evidenced by their diplomas or certificates.

The Danish plan of a provisional appointment to public office for a limited period, say of six months, in order to determine practical fitness, before the appointment is confirmed, has very decided advantages. This proceeding is perhaps more applicable, however, to the position of medical officer of health, than it is to some of the subordinate positions.

For the training of public health workers not only is it necessary that some knowledge of man's structure and the functions of his various organs be learned but his relation to his environment must be understood. The practical consideration of costs and of structural detail must not be lost sight of, since much of our program must needs be constructive. Above all things, a knowledge of mankind is quite as essential as a knowledge of man. Human nature will continue to be just as important a factor in the future as in the past. Men and women of exceptional caliber and of great breadth and depth of training are needed, and will be forthcoming just as rapidly as the public realizes its need. Our problem, then, is largely that of developing public interest and support by the rationality of our methods of work and of our recommendations for the betterment of existing means.

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[1] Article published in the Journal of the Minnesota State Medical Association and Northwestern Lancet.

THE TRAINING OF SANITARY ENGINEERS.

GEORGE C. WHIPPLE, Professor of Sanitary Engineering in Harvard University.

Within the last quarter century a new profession, sanitary engineering, has come to the fore. It represents the application of a new science to a new product of civilization. The new science is bacteriology; the new product of civilization is the modern city.

How important sanitary engineering is to the world to-day is scarcely realized, so gradual has been its evolution, but its importance may be appreciated by comparing the conditions of life in our cities to-day with the conditions that existed in ancient days, or even a few generations ago.

The world has always had its cities. Man is a gregarious animal. The cities of long ago developed to their limit, then fell into decline, and in many instances disappeared altogether. Sometimes they were destroyed from without by their enemies; sometimes they fell victims to the cataclysmic forces of nature; but often they fell from more insidious causes; from diseases that swept through their inhabitants until great aggregations of people were reduced to mere handfuls, and those that remained were scattered through fear and starvation.

Two potent factors limited the growth of ancient cities; lack of transportation and ignorance of what constitutes hygienic environment. Without adequate transportation, the food of cities was limited to local supplies. If these failed, famine followed, and the people fled to where food could be found. Coast cities could receive supplies by water, and some of the old maritime cities long maintained their supremacy, but large inland cities, as we have them to-day, were formerly unknown. Without knowing how to control transmissible diseases, with no better theory than that they represented the visitation of an angry Providence, no wonder that famine was followed by pestilence and that, as cities became more crowded, the wider was the spread of the dread calamity.

Our modern cities, far greater in number and size than ever before in the world's history, are made possible, first, by the development of transportation by road and rail and fast steamships, so that food from afar may be brought to the homes of the urban dwellers; and, second, by the development of the arts of sanitary engineering, by which the people are supplied with pure water and pure air and the waste products of life safely and inoffensively removed. Other influences, of course, have contributed, but among them all the work of the sanitarian is conspicuously successful and conspicuously modern.

To give a simple, adequate definition of sanitary engineering is difficult. From an early application to plumbers and expert drain layers the term has grown in importance, as the works have grown in magnitude, until it now includes civil engineers engaged in providing public-water supplies, sewerage systems, garbage-disposal works, methods of cleaning streets and draining swamps, as well as engineers whose interests are chiefly indoors, and who are engaged in providing systems of plumbing and ventilation for buildings. If the civil engineer be defined as " he who adapts the great forces of nature for the use and convenience of man," the sanitary engineer may be correspondingly defined as " he who, through the construction and operation of engineering works, adapts the forces of nature to the preservation of the public health."

The problems of the sanitary engineer are so vast and so varied and bring him into contact with so many branches of science and with so many classes of people that an exceptionally broad education is demanded. Engineering is fast coming to be regarded as one of the learned professions, and the education required of one who enters this profession must be not only scientific and technical but broad and humanitarian. He must not only know the underlying principles of the mechanical sciences but, if he is to become the director of great enterprises, he must have the power to think logically and to reach conclusions quickly, to write clearly and to speak forcibly, not to mention such moral qualities as honesty, enthusiasm, and that vague something termed " personal magnetism."

Some of these qualifications are inherent in the individual. some come with experience, but the power to think and speak and write can be acquired by study and practice. It is partly because of this need for broad-minded engineers, and partly because science itself is becoming so broad and its branches so interwoven, that the applied sciences are being taught more and more as graduate courses in our universities, and that the technical schools are looking forward to longer courses than the usual period of four years. This need of an extended education is particularly true of sanitary engineering, for, more than some of the other branches of engineering, it requires the aid of many sciences. Not only must the sanitary engineer be versed in mathematics and mechanics, but he must have a working knowledge of parts of chemistry, biology, bacteriology, microscopy, meteorology, geology, hygiene, preventive medicine, and vital statistics. Unlike other branches of engineering, sanitation is concerned, not alone with iron and stone and other inert building materials, but with organic matter and living things. The purification of water and sewage is due largely to biological action, and the knowledge of bacterial processes is scarcely less important to the sanitary engineer than that of the laws governing the flow of water in pipes and the strength of materials.

While this is acknowledged, it is also true that first and foremost the sanitary engineer must be an engineer and that the collateral sciences must be subordinated. Hence the student must be trained primarily in engineering and secondarily in sanitation. The emphasis is important. It can not be successfully reversed. Sanitary science teaches the student why this or that structure is needed, but it does not teach him how to design or how to construct, and these are for him the very fundamentals of his profession. The wisely arranged curriculum will therefore cover the field of sanitation in a broad and general way without taking too much of the student's time from his detailed studies in structures and hydraulics.

But sanitary science is becoming so important that there is room not only for the constructing engineer but for the sanitary specialist, and for him whose duty it is to operate the works after they are built, to take charge of the water filters and the sewage-treatment plants, to manage the garbage works, and to superintend the cleaning of the streets and buildings. Such men need a slightly different training from the others, and the ideal course would give less attention to civil engineering features and more attention to mechanical engineering and laboratory work. Also, more attention should be given to the subjects of accounting and scientific management. This need for capable managers of sanitary works will soon be a pressing one, and our technical schools must be prepared to furnish men for this service

Besides the sanitary engineer and the specialist in sanitation, the world to-day needs—and the need is very great—a kind of man just beginning to make his appearance; namely, the sanitary executive, or, as he is more often called, the health officer. There are already many so-called health officers serving on boards of health or employed by them. Some of these men are great leaders, well worthy of the honorable positions they hold, but the rank and file of them are ill fitted for their important task. Our public-health machinery was installed when the hygienic wisdom of the town was wrapped up in the family doctor and when the physician was the logical custodian of the public health. With the growth of the science of bacteriology and of preventive medicine, and the application of engineering, all this has changed. The ability to diagnose a case of smallpox and to keep a record of deaths is no longer a sufficient qualification for the health officer of even a village, while the growth of our cities is making it increasingly necessary that the men in charge of the public health of so many people shall be experts in their line.

Medical training alone does not fit men for this service. The problem of curing disease is quite different from the problem of preventing disease. The former deals with human beings as individuals; the latter considers them as units of a mass. The prevention of disease involves mathematics; statistics relating to the sick and the dead must be constantly used in order to show what forces of disease are at work and where the attack is likely to be made next. It involves engineering, for the public must be protected against impure air and infected water, streets must be cleaned, and garbage removed. It involves chemistry, for the public must be protected against the sale of adulterated and poisonous foods. It involves bacteriology, for infectious diseases must be diagnosed and antitoxins provided. It involves law, for the health officer must be able not only to discern evils but to eradicate them. But the duties of a health officer should not be entirely repressive and punitive. There is a positive side. His department should be an educational force in the community, constantly instructing the people in the arts of hygiene and in the principles of right living. Many believe that this educational function of the health officer is one of the most important of his duties.

In the pursuit of the elements of sanitary science the sanitary engineer, the sanitary specialist, and the health officer meet on common ground, and, to a certain extent, their education may be appropriately conducted together. But, for the most part, their work, although mutually helpful, lies apart and their education in the main should follow separate channels. The health officer needs his special work in the study and control of diseases, in the use of vital statistics, and in other subjects that tend to fit him for an executive. The sanitary specialist needs extensive laboratory experience and practice in research, while the engineer needs to work with his surveying instrument, his drafting board, and the other tools of his profession.

As an illustration of modern tendencies in the training of sanitary engineers, mention may be made of the newly established courses in the School of Engineering at Harvard University.

Here sanitary engineering does not lead to a special degree, but is considered as a branch of civil engineering; in fact, all students in civil engineering are expected to take the general course in this subject. The same course is also open to candidates for the degree of doctor of public health in the medical school. For those who intend to engage in sanitary work at once after graduation, courses in water-supply engineering and sewerage engineering are offered during the last term, and in these the students receive such detailed instruction as will fit them for the kinds of practical work that will be expected of them.

This instruction is not given in the form of classroom exercises, but as individual work carried on as it would be in the office of a practicing engineer. Much, too, is made of the study of actual works in operation for the benefit of those who intend to enter this field. The extent to which specialized subjects in sanitary engineering should be taught is a difficult matter to decide. Generally speaking, experience has shown that in our technical schools specialization has been carried somewhat too far. In the writer's opinion it ought to be carried only far enough to incite the permanent interest of the student, and enable him, on graduation, to take up some particular line of work intelligently and with such a degree of skill that he can earn a reasonable income during the early years in which he is getting his real experience in his chosen profession. In later years it is the effect of his general studies rather than of his special studies that make for his success. In other words, it is mental culture, after all, that counts.

One feature of interest in connection with the Harvard School of Engineering is the fact that it continues through the entire year, utilizing the time usually devoted to the long summer vacation. This enables the student to accomplish his engineering studies and obtain his master's degree in two full years after receiving his bachelor's degree. The summer work is of particular advantage in the study of certain phases of sanitary engineering, as it enables field work to be carried on at a season when the biological processes are at their maximum and when material for study is readily available.

From the Harvard School of Engineering, one of the latest to take up this field, let us turn to the Massachusetts Institute of Technology, a pioneer in American sanitation. Since 1889 nearly a hundred men have taken the bachelor's degree in sanitary engineering, and many other graduates in civil engineering, chemistry, and biology have taken up sanitary work. The influence that these men have had on the public health of our country can not be measured, but the lives that have been saved by the works they have built are numbered by thousands, and by these works our cities are being made cleaner and better and safer places in which to live. The American cities owe a debt to the Massachusetts Institute of Technology and to the other universities that they can repay only by their most cordial and generous support.

Sanitary engineering is yet in its youth. Its practice is far from being crystallized. More than other branches of civil engineering, therefore, it demands research. Half a million dollars has been spent in this direction by our States and municipalities, but the research carried on by our universities has not been as great as might be expected. Additions to university funds for this purpose would bring important results. Immense sums have been given as endowments for research in the cure of disease and in preventive medicine. But it has hardly yet been realized that the great life-saving agencies are carried out by engineers and that by improving the engineering arts vast sums of money may be saved. Our country is justly proud of the work of the United States Government in preventing disease at the Isthmus of Panama and in showing how the Tropics may be safely inhabited by white men, but this work has been very expensive. The next step in advance is for the sanitary engineer to accomplish the same task at greatly less cost. This step is absolutely necessary. Research in sanitary economy is therefore one of the directions in which money may be well spent during the next decade.

The demand for young sanitary engineers is continuous and is increasing. There is little doubt that men who enter this field will find useful service and a competent livelihood. This is ample reason for a young man to study the subject. But there is another reason which is inherent in the training itself. A piece of iron, to be welded into a useful tool or a thing of beauty, must be heated white hot and then hammered into shape. So a student must be first inspired until his enthusiasm glows, then he must receive the blows that will shape his mental processes so that they will follow naturally along the track of sound logic and sane thinking. No better combination exists for producing this result than the inspiration to be derived from the wonderful prospect of a world saved by sanitation and the hard mental work required of him who would be a sound and competent engineer.

THE TRAINING OF VISITING NURSES.

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The special branch of nursing known as visiting nursing, has presumably been chosen for discussion because its relation to public health is obvious and important; but its choice should not convey the idea that other branches of nursing are not also greatly concerned with public health. Three large general divisions have been established in nursing, and three corresponding groups of workers: Nursing in hospitals and kindred institutions; private nursing in families; and visiting nursing among the sick poor in their homes, lately extended into schools, shops, and factories.

By far the most important branch of nursing is that carried on in the several thousand hospitals, which have grown up with almost spectacular rapidity and variety during the last two decades. Many of them are at once centers for relief of sickness and suffering, and also for the maintenance of important systems of education, and for scientific study, research, and experiment. Over 1,000 hospitals in this country are ranked as training hospitals, in which the main staff of workers is composed of students of nursing, and the transformation in the hygienic conditions of hospitals wrought during the last half century by this modern system of nursing, is one of the most striking contributions to hospital development which history has to record. The extreme cleanliness, orderliness, and hygienic care and control observed by the nursing force in the modern hospital are essential factors in the cure of the sick and their speedy restoration to society; while much of the research and experiment, upon which advances in medicine and surgery depend, can not be undertaken without the cooperation of a carefully educated nursing staff. It is hardly too much to say that the modern system of nursing brought hygiene into hospitals and keeps it there, thus lifting enormously the importance of hospitals in relation to public health. It is roughly estimated that in the hospitals of the country, if we include the staff of officers and other salaried graduate nurses, there are today about 50,000 nurses.

The relation of the nurse engaged in private practice to public health is worthy of a moment's attention. Going from household to household, familiar, in the most intimate way, with the family life, its traditions, and its habits, the opportunity to advise and suggest improvements in household hygiene and sanitation comes to her continually. The opportunity, indeed, is so great as to prove an embarrassment, but when the nurse, in addition to her actual nursing work, is able to persuade the well-to-do family that flies and mosquitoes do really mean mischief; that window screens are a good investment; that the habits of even pet dogs and cats do not render them suitable objects to be kissed and fondled by babies; that the pretty, little, wayside brook ought usually to be resisted, no matter how thirsty, she becomes a useful agency for the protection of health, her efficiency and influence depending only upon the extent and thoroughness of her knowledge. Two things have proved continual matters of astonishment to nurses in their work among private families: The first is the rudimentary or erroneous ideas of ordinary house and personal hygiene frequently found among well-to-do people; and, second, the degree of confidence reposed in the nurse as one who should be able to answer, intelligently and helpfully, questions on these matters, and to support her views by authoritative and convincing evidence. There are probably none present who will not say that the opportunity thus given the nurse to forward public health is a valuable one, and that the nurse should be able to use it fully and wisely.

The relation to public health of that branch of nursing known as visiting nursing in America (district nursing in England) is close and definite, and so clearly recognized that when recently a large body of visiting nurses came together to form an association they could find no appropriate title to define their work but the one they finally chose, the National Organization for Public Health Nursing. From the very beginning of their visiting among the sick poor, nurses have been using some of the methods of modern health crusades. They have held it as a cardinal principle of their work that in all instances where it is practicable the care and relief of sickness must be accomplished by teaching and by demonstration of a hygienic nature. In the plans of work and instructions to workers, dating back nearly half a century, it will be found laid down among the special duties of the nurse to teach the patient and the family the necessity of cleanliness, fresh air, and proper feeding, especially for the children; and they were urged to be "diligent in pressing necessary instructions as to the sanitation of their homes in the families of the poor."

Beginning 50 years ago in England, with one nurse supported by one philanthropic man in one small city, district visiting nursing there has now become in that country an important national asset, and has about 1,000 associations and several thousand nurses affiliated and working under the direction of a central body, with a highly organized system of supervision and inspection. In America the work began some years later, and for a time moved slowly. Ten years ago there were something like 50 centers from which visiting nursing was carried on, but such rapid development has since taken place that in 1909 there were over 500 such centers from which nurses were working, and this year there are reported up to date over 1,000, with the number of workers more than doubled. The growth in numbers, however, is not more significant than the expansion of work into avenues surprising to the nurses themselves or than the enlargement of responsibilities which have accompanied the expansion.

The public-health movement, addressing itself successively to the three graver and more urgent problems of the day, namely, tuberculosis, the health of school children, and the mortality of infants, called promptly upon nurses for cooperation. For, in accepting education as its guiding principle, its supreme task became that of getting the needed knowledge, in practical usable form, into the homes and daily habits of the people. It found in visiting nurses an agency already in the field, ideally adapted for the work by training and by special interest; known, accepted, and generally beloved in the homes of the poor. In the campaign for the prevention and control of tuberculosis the visiting nurse shortly appeared as an essential factor in any adequate scheme for handling this problem. The tuberculosis patient in his home must be under expert sanitary control and supervision; he must be nursed; he must be taught, and his family must be taught and in a sense nursed, since the beginnings of symptoms among the healthy members must always be watched for, the neighborhood must be protected, and careful records must be kept. Quite recently Sir William Osler wrote on this subject:

> The work that district nurses may do in connection with tuberculosis is of the greatest value. I have had experience of it now for many years. Visiting the tuberculosis patients at stated times every week, watching over them, seeing that they carry out the regimen systematically and regularly, it is wonderful what good results may be obtained by guidance, by control, and by the proper education of the patient.

Quite recently also a well-known authority referred to the visiting nurse in tuberculosis as the " crux of the whole situation."

With the growth of medical inspection of schools the school nurse has become a necessity, and no efficient work in this field can be done without her. She visits the schools, assists the physician, inspects the children, attends to minor ailments, and visits the home of the children to carry the physician's instructions and to help the parents to secure proper treatment. She watches over the children, keeps careful records of conditions, in some schools gives general talks and demonstrations in elementary hygiene to the children, in others has supervision over some features of school sanitation; an all-useful person, reminding one of our Mr. Dooley's latter-day doctor, who explained that the diminishing use of drugs was making his duties " those of a janitor with some knowledge of cooking." The main results of bringing the nurse into the scheme of medical inspection are that epidemics are prevented, school attendance increased, a higher standard of cleanliness and health among the children is obtained, physical defects are discovered, expert supervision is established, records are secured.

Turning to the movement for the prevention of infant mortality, we find everywhere the same tendency to lean heavily upon nurses as indispensable agencies in teaching mothers how to feed and care for their babies, and in the practical handling of work in milk stations and similar agencies. In England, district nurses are employed in ways as yet unthought of in America. Under the notification of births act of 1907, a number of them have been appointed as health visitors, whose duty it is, when notified of a birth, to visit the home, examine the child, note its condition, especially any defects, and instruct the mother how to feed and care for her baby. In London, where the notification of opthalmia neonatorium is compulsory, visiting nurses are again employed to visit such cases and to see that treatment is carried out.

In these three large fields of public-health work, then, nurses have proved an essential and indispensable factor, and it seems certain that as other aspects of the general health movement become ripe for development they, too, in turn will require such services as the nurse, and perhaps the nurse only, is at present qualified to render. Visiting nurses, called "welfare nurses," are employed in shops and factories to watch over the health of their employees, and to visit them in illness and to teach them the elements of personal hygiene, and this branch of work is steadily increasing.

Sanitary inspection in its various forms is beginning to attract nurses, and as inspection without instruction is about as futile as medical inspection of schools used to be without the cooperation of the visiting nurse, it is to be hoped that nurses will enter vigorously and largely into work which bears so close a relation to public health. A well-known inspector of tenements in New York writes:

> The nurse has exceptional opportunities for educational work. I have been interested again and again to have families tell me that hygienic precautions taken by them, such as admitting sunlight and fresh air, banishing dust-holding heavy hangings and old carpets, using disinfectants and antiseptic cleansing, proper methods of sweeping and dusting, care of plumbing, exclusion of disease-carrying flies, outdoor care of tuberculosis patients, or the like, were taught them by nurses. Perhaps the nurses themselves would be surprised to know how many of their teachings are remembered by the families long after. And, again, the onlooker can not but see with amazement the amount accomplished by the visiting nurse in her complex and difficult task. Her intelligent, far-reaching work brings results, not only to the whole family of the patient, but to the whole community, which others working in the same neighborhood can not fail to see.

In several directions there are beginnings of work which seem to hold out promise of much usefulness, not the least of which is the employment of visiting nurses by certain large insurance companies to visit and care for their policy holders in illness. It must gratify Irving Fisher to see his suggestion that the true function of the insurance body is the protection of health, beginning to take effect in so practical a way.

Dr. Newmayer, head of the division of child hygiene, department of health, Philadelphia, projects upon the canvas the figure of the future health nurse:

> The municipal nurse is destined to be the guardian of public health in the same sense that the police are the guardians of public safety. The time is near when we must have a nurse for every section of the city, and she will be responsible for the health of the citizens of the district she patrols.

Now that science is becoming the controlling factor in everyday human affairs it seems to be imperative that newly discovered truths of a vital nature should as speedily as is practicable be brought home for the uses of all classes of the people. As Mrs. Richards said: "Our laboratory wisdom must reach the street." The visiting nurse must become a sort of middleman of science.

Now, if the problems of sickness in the homes of the poor and health in city districts could be met by skilled nursing and the teaching of sound sanitary doctrines, the visiting nurse would unquestionably be the main agency in controlling the situation. But with overwhelming evidence on every hand to show how constantly and almost inevitably sickness is bound up with other conditions, such as poverty, occupation, incompetence, heredity, and a host of other contributory factors, and how essential it is that these also be recognized, studied, and treated, it is becoming more and more clear that medical and nursing skill can not alone reach far enough to adequately handle the whole problem of which sickness is only a part. When doctor and nurse have done their utmost from a medical and nursing standpoint, there may yet be needed another diagnosis and other adjustments, and on the whole it may not be much more dangerous to society to have a wrong diagnosis and unskilled treatment of the social aspect of the case, than of the medical and the sanitary.

To illustrate, let us take a single but pretty constant factor in the situation which calls for the nurse's services, namely, extreme poverty and urgent need of one kind or another, a condition distressing to the nurse, because it handicaps her in her good work, and consequently retards progress. Yet every situation demanding material relief calls at the same time for careful investigation and sound judgment and action, and to secure this, bodies of eminent men and women have for nearly a century been giving profound thought and study to this vital question of relief. They have from experience and experiment built up a substantial body of principles and have established certain procedures. Lacking a knowledge of these principles, one is no more qualified to give relief than to prescribe medicine and diet for the sick without medical training. This particular point is used because, from the beginning of visiting nursing, the question of relief has proved a perplexing problem, and even in the very earliest days it became necessary to throw restrictions around the giving of indiscriminate relief, lest nurses should "degenerate into almsgivers." The modern trained social worker stands aghast at the easy confidence with which the nurse takes control of the social machinery affecting her work as a nurse, and there is much criticism and the friction which always arises among workers when functions and provinces are not clearly defined nor wholly understood.

The matter is largely one to be settled by further education, and this brings us to the important question of the training of the visiting nurse. It is generally recognized that two or three years in a good hospital training school is in many ways an incomparable foundation for public-health nursing. The nurse first learns to respect work, and to do it thoroughly, conscientiously, and in a systematic and orderly fashion. She grasps the enormous significance of cleanliness and maintains high standards of personal and household hygiene. She has become a close observer of symptoms, understands their meaning, is made familiar with the many aspects of disease, has become technically expert and highly capable in the actual nursing of the sick, and hospital life has both disciplined and fortified her for life's tasks. All must agree that here is an excellent foundation. Now, what further is needed? Those who, either as medical men, teachers, or social workers, have been in closest and most sympathetic relationship with nurses in various forms of public health work, and nurses themselves so occupied, are in pretty substantial agreement as to the main ground to be covered in further preparation beyond that which the hospital training school at present affords. They all agree that a sounder scientific foundation should be given and that better grounding in physiology, bacteriology, and chemistry is required. The latter subject, notwithstanding its intimate relation to nursing procedures, to sanitation, to the entire problem of food, diet nutrition, and also to drugs and disinfectants, is not at present in the curricula of hospital training schools. It should be provided. They insist that the public health nurse be instructed in at least the elements of sociology, and, further, that she be acquainted with legislation affecting women and children, the family, the tenement, and household industries, and with sanitary laws relating to milk and water supply, removal of refuse, street cleaning, etc. Especially important is deemed some instruction on the causes of poverty, the history of poor relief, juvenile courts, and probation work. And it is urged that the visiting nurse should become familiar with the purpose and interpretation of statistics, in order that she may utilize wisely her extraordinarily rich and constant opportunities for obtaining valuable data.

Elementary psychology is recommended as a desirable preparation for those who must constantly study the mental attitude of their patients and families. If this can be made to include something of racial traditions, superstitions, and sentiments, it will be all the more helpful. Languages, particularly Italian and German, are urged as a highly important and in some places a necessary equipment.

In addition to this, it is further insisted that, while the foregoing general ground should be covered by all visiting nurses, those nurses who are engaged in such special work as tuberculosis, school nursing, or infant-welfare work, must make thorough special studies of the particular fields in which they intend to occupy themselves. It is quite impossible to expect such preparation in the ordinary hospital training school.

In most general hospitals, for instance, tuberculosis patients are not admitted, and throughout the entire course but one lecture on this subject may be given. But the tuberculosis nurse should be an expert in this work. In school nursing a wide knowledge of children, of their growth, diet, nutrition, habits, and of their particular ailments is essential, yet many hospitals have no children's department, and the instruction in this important branch of work is limited to a few lectures and to a few fragmentary chance experiences.

Infant feeding, with the hygiene of infancy, has become a science by itself, and neither in theory nor in practice does it form an invariable and definite part of a nurse's training.

For the nurse, then, who is to play that large part in the public health movement which is now being so generally and so confidently assigned her, there is a general demand for better, more thorough, and more liberal training. Part of this can be secured in the training school, during the three years of her work there, and the demand for it will prove helpful in stimulating such schools to further effort. Part of it must be obtained by special graduate training in special places, such as tuberculosis dispensaries and sanitaria, in children's hospitals and clinics, and in the special study of infancy and its problems. Courses in social problems are offered in some universities and in the schools of philanthropy which are arising throughout the country. In a few colleges courses in city sanitation are now available.

Finally, it becomes necessary to take up the whole question of public health from the standpoint of visiting nursing, as distinct from hospital or ordinary private nursing, and to secure from expert workers in this field the rich results of their experiences embodied in established principles and procedures. Efforts to gather together from the various sources of supply the knowledge and instruction needed for public-health nurses are now being made in Cleveland, Ohio, where the Visiting Nurses' Association has allied itself with Western Reserve University and with the associated charities in a course of instruction; and in Boston, where the Instructive Visiting Nurses' Association unites with the School of Philanthropy and with Simmons College in a year's work. For three years past Teachers' College, in its department of nursing and health, has offered courses to prepare for public-health nursing and for the organization of such courses of training in other institutions.

Unquestionably we have in visiting nurses, wherever they may be, a body of women who are, on the whole, a highly valuable asset to national health and welfare already distinguished by the excellence of their work and by the high quality of their unselfish and devoted service. They should be encouraged to recognize and to make good the deficiencies in education and training which have been here discussed and to realize that good practical work and devotion alone are not a large enough equipment for those who would share worthily in the more difficult and complex labors of mankind.

THE FIELD OF THE DEPARTMENT OF PHYSICAL TRAINING IN EDUCATIONAL INSTITUTIONS IN THE DEVELOPMENT OF PUBLIC HYGIENE.

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In reviewing the growth and development of the department of physical education in our higher institutions of learning during the past 50 years it is interesting to consider the methods pursued, the mistakes made, the results attained, and the present trend of this important movement.

The first introduction of physical training into our educational institutions was largely as a health measure, when one or two college presidents and prominent educators began to call the attention of their various alumni to the deterioration of the health of college students. As early as 1860 Amherst appointed a professor of hygiene and physical education, and eight or nine years later Bowdoin, Princeton, and a few other colleges appointed directors to their gymnasia. The building and equipping of gymnasia at this time was largely a hygienic measure. Another factor which promoted the growth of physical training was the increasing athletic interest. In the early sixties baseball and rowing had become quite prominent features in a few of the eastern colleges, and in 1874 the Intercollegiate Athletic Association was established, holding its first meeting at Saratoga. When, in 1878, the Hemenway Gymnasium was erected at Harvard recognition was given to this athletic interest of the students by furnishing them special rooms for rowing and baseball practice, as well as for boxing, fencing, and wrestling. Special consideration was also given to the nonathletic student by the adoption of voluntary class exercises and the introduction of some 30 or 40 developing appliances for individual use. The building and equipping of the Hemenway Gymnasium along modern lines and the establishment, in 1887, of a summer school at Harvard for the training of teachers afforded a great stimulus to physical education throughout the country.

As I have previously stated, the early introduction of physical training into our educational institutions was largely to improve the health of the students. They were required to attend a few lectures on physiology and hygiene, usually during the freshman year, in which they were given good advice as to the personal care of their health. In many institutions these lectures were supplemented by required attendance at the gymnasium for from two to four hours per week. But for many years, in most of these colleges, no credit toward a diploma was given either in the courses in theory or in practice. Later some institutions gave credit for the course of lectures, but none for the work in the gymnasium, while more recently a few have given credit for both.

As we examine the status of the department of physical training in our various colleges and universities we see this same process of evolution still going on. This early failure to give academic credit to the study of physiology and hygiene was only a phase of the old warfare that has persisted for generations between science and theology; just as a refusal to incorporate industrial instruction in our high-school curriculum was a tacit acknowledgment that education, in some mysterious way, was a detachment from ordinary life.

Physical training, in its best sense, is nothing but applied physiology and hygiene, and the soundness of the theory depends upon the realization of the practice. Having at last recognized the importance of teaching physiology and hygiene, it would seem only a step to the recognition of the practice of physical training as a part of the regular curriculum. Yet it was a long time before required physical exercises were made a part of the curriculum and given as credit toward a degree. To require students to attend the gymnasium and practice good hygiene, but give them no credit for the results attained, was a great tactical mistake on the part of the school and college authorities. Required exercise for health's sake soon began to be considered a nuisance and a bore by a large majority of our students. Many felt that it made too severe a strain upon their good intentions; others regarded the effort in that direction as too individualistic and selfish. Certainly there was little about exercise for health's sake, as at first conducted in our institutions of learning, that tended to appeal to youthful pride or to arouse any physical or moral enthusiasm.

Our boys and young men naturally pride themselves upon their strength, skill, courage, agility, and endurance, and our girls and young women upon their grace, beauty, dexterity, and comeliness. Anything that promises improvement in these qualities immediately arouses their interest and enthusiasm. Here is where strength tests, gymnastic accomplishments, athletic achievements, and exhibitions in dancing and calisthenics have played an important part in stimulating our young men and women to make efforts which have led to their physical improvement.

Ambition to excel in some of these physical accomplishments, and not health alone, or bodily perfection, for its own sake, has become the chief incentive to physical training. In order to get in good physical condition for an athletic contest or to excel in some particular game or sport, many students of both sexes have adopted improved methods of living, or, in other words, have begun the practice of applied hygiene. "How much exercise should we take daily?" "What is the best training diet?" "What is the best kind of a bath?" "How many hours should one sleep, and should one sleep in the open air?" "What kind of clothing should one wear?" These are some of the questions that come pouring in upon the physical director from school and college youth and indicate the growing interest in personal hygiene, evolved from a very vital aim, and not superficially coerced. But this interest does not stop here; it goes out into the home, the office, the manufacturing establishment, and the workshop, and is affecting all classes of society. This is true not only of those who aspire to be athletes, but of an ever-increasing number who are learning from the stimulus of necessity that they must keep themselves physically fit and learn to live correctly if they wish to retain a remunerative position. In this way interest in personal hygiene, which has been stimulated largely by athletics, has also extended to a concern for general sanitation, public health, and municipal hygiene. Just as many an athlete attributes his defeat to poor ventilation, change of environment, or defective food or water supply, so whole classes of workers can trace the ailments characteristic of their occupations to neglected arrangements for their health.

To-day, in some communities, the ordinary laborer or factory employee demands good sanitary conditions or refuses to work on the premises. Thus we see that it is only by the gradual enlightenment of the common people in personal hygiene that real progress in public hygiene can be made. There must be a scientific training in the feelings of personal responsibility and of individual citizenship toward the truths which the researches of the world's great experimenters put before us.

In their failure to early recognize personal hygiene, in practice as well as in theory, as an integral part of the school curriculum, many of our institutions of learning have hampered not only the cause of public hygiene, but of public education also. This regretful condition was brought about by several factors: First, the difficulty of getting young men of character and ability to take up as a life work the teaching of hygiene applied through physical training; second, the early advent of the so-called professional trainer, with his false methods, standards, and ideals; and, third, the resort to great athletic contests and public spectacles as a means of raising money to defray expenses of training and conducting games.

I have already alluded to the fact that the present interest in personal hygiene among our school and college boys came to them at first largely through athletics. Thus the professional trainer, being nearest to them, was the man from whom they usually received their instruction in applied hygiene. If the students' athletic achievements were anything remarkable, the professional trainer came in for his share of the credit and glory. If the student athletes were defeated the trainer was correspondingly condemned and usually lost his job. Victory being the only accepted criterion of success, "anything to win" early became the motto of the professional trainer. If he was intelligent he soon realized the limitations of his profession, and learned that most athletes are born and not made; hence, the chief aim was to discover new men and to do what he could to exploit their athletic prowess. This practice led to all the evils of "professionalism" among our school and college athletes, and few institutions escaped the odium of this form of commercialism.

These evils were made possible by the large gate receipts, frequently ranging in the large colleges from $10,000 to $50,000 from a single football game. The surplus left over from these big games has always afforded a constant temptation to pay large salaries and to indulge in all sorts of extravagances with the view of enhancing the chances of victory over rival athletic teams. The payment of salaries of from $3,000 to $7,500 per annum to special athletic coaches and trainers for a few months' work has been thoroughly demoralizing, not only to the regular instructors in the gymnasium employed by the school or college, but also to the instructors in the other branches of education. In a way, the large salaries paid to athletic trainers and coaches are warranted, because, under such a system, there is no security in their tenure of office. This is another reason why college men of the essential qualifications have been loath to take up the physical work and the teaching of applied hygiene as a profession. At the present time our system of athletics, as conducted by the students, resolves itself into a system of selection and elimination, where a few of the physically best men are chosen from each class for special training, and the remainder left to look after themselves. This custom is equaled in narrowness only by the system of selecting scholarship men adopted by many college faculties. To select such men upon an intellectual basis only, thereby putting a premium upon their neglecting their health and physique in view of improving their minds, is not only not good hygiene, but, in the light of our present-day knowledge of the intimate relationship of mind and body, not good sense.

As a result of this mistaken policy, some of our institutions are fostering two distinct classes—one class which attends college largely for its social and athletic advantages, and the other largely for its intellectual opportunities. One class is prone to neglect mental work, and carry athletics to excess; the other class is inclined to neglect physical training, and carry mental efforts to excess. Both classes have a sort of quiet disdain for each other; and neither class is leading strictly hygienic lives nor advancing the cause of education in its best and noblest sense. We need to broaden our conception of education so that it will embrace the whole man and all that concerns him. We want to be able to say, with Prof. Youmans:

> Education is an affair of the laws of our being, involving a wide range of consideration—an affair of the air respired, its moisture, temperature, density, purity, and electrical state; an affair of food, digestion, and nutrition; of the quantity, quality, and speed of the blood sent to the brain; of clothing and exercise, fatigue and repose, health and disease; of variable volition and automatic nerve action; of fluctuating feeling, of redundancy and exhaustion of nerve power; an affair of light, color, sound, resistance; of sensuous impressibility, temperament, family history, constitutional predisposition, and unconscious influence; of material surroundings, and a host of agencies which stamp themselves upon the plastic organism, and reappear in character; in short, it involves that complete acquaintance with corporeal conditions which science alone can give.

Thoroughly imbued with these ideals in education, some of us have been working persistently along these lines for the past 40 years. I am happy to state that we have been making some progress. Through the combined influence of the biologist, the physiologist, the psychologist, the sociologist, the hygienist, and the physical trainer practical education is beginning to realize the bearing of physical conditions upon mental and moral life. Slowly but surely our institutions of learning have been coming into line and are adopting some method of teaching applied hygiene. Up to the year 1910, from Dr. Meylan's report made to the college gymnasium directors and the American School Hygiene Association, it was estimated that 98 per cent of the 136 colleges and universities in the list of the Carnegie Foundation had gymnasiums; 94 per cent had regular instruction in gymnastics and 80 per cent in athletics; in 75 per cent of these institutions the director of physical education has a seat in the faculty, and in 87 per cent some form of physical training is prescribed. A recent investigation[1] of 391 colleges, universities, mechanical and agricultural schools all over the United States shows that about 43 per cent of all, and about 70 per cent of those that have recognized departments of physical training, have well-defined courses in personal hygiene, sanitation, and public health, either connected with physical training or with some other department.

Concerning the number of secondary and elementary schools that have adopted some system of physical training I have no exact data, though I know from the number of teachers employed that the number must be large. The practice of teaching applied hygiene has been further extended through the work of trained and partly trained instructors, such as directors or superintendents of physical training in the public schools of large cities and towns, directors of Young Men's and Young Women's Christian Associations gymnasia; directors of public playgrounds, municipal gymnasia, park gymnasia, industrial and social unions, and settlement work; instructors in physical training in manufacturing establishments, department stores, reformatories, hospitals, sanatoria, church missions, boys' and girls' clubs and summer camps, military posts, and private gymnasia for remedial and corrective gymnastics. As a result of the extended interest in general hygiene we know that the amount of sickness has been greatly reduced and the average life much prolonged. As one factor in the reduction of morbidity and the death rate we think that the interest in physical training has played an important part. But up to the present time the chief value of physical training and hygiene has been in increasing the functional power of the individual, and in building up and developing higher types of manhood and womanhood. As evidence of this functional improvement we may point with pride to the decided increase in the average height and weight of college students of both sexes that has taken place during the past 30 years, and the marked improvement in all classes of athletic performances. At Harvard University, in 1880, the height of the average student was 67.7 inches and the average weight 135.2 pounds. At the present time the height of the average student is 68.7 inches and the average weight 141.6 pounds. The average strength has increased by about one-fourth. The improvement in general athletic ability that has taken place since the organization of the Intercollegiate Athletic Association in 1875 may be inferred from the great improvement in the records. The best and poorest annual championship performances recorded during the past thirty-odd years are as follows:

	Poorest.	Best.
100 yards run	11 seconds	9⅘ seconds.
220 yards run	24⅖ seconds	21⅕ seconds.
440 yards run	56 seconds	48⅘ seconds.
880 yards run	2 minutes 20½ seconds	1 minute 56 seconds.
1-mile run	5 minutes 33 seconds	4 minutes 25 seconds.
2-mile run	10 minutes 3⅖ seconds	9 minutes 34⅘ seconds.
120 yards hurdle race	21⅗ seconds	15⅕ seconds.
220 yards hurdle race	26⅘ seconds	23⅗ seconds.
Running broad jump	18 feet 3½ inches	24 feet 4½ inches.
Running high jump	4 feet 11 inches	6 feet 3¼ inches.
Putting the 16-pound shot	30 feet 11½ inches	46 feet 5½ inches.
Pole vault	7 feet 4 inches	12 feet.
Throwing 16-pound hammer	75 feet 10 inches	164 feet 10 inches.

Although improvement in material conditions and implements used have contributed in a measure to the gain in athletic records, superior athletic ability supplemented by judicious training have been the chief factors. As an indication of the influence of heredity, nurture, and environment, upon a class or community, the measurements of public and private school youth may be taken as good evidence. From observations made at Harvard on a thousand freshmen from the classes of 1912, 1913, 1914, and 1915, it was noted that the 451 students who came from the public schools averaged 68 inches in height and 136.7 pounds in weight, while the 579 who came from the private schools averaged 69.5 inches in height and 145.5 pounds in weight. This is a difference of 1½ inches in height, and 8.8 pounds in weight, in favor of the students from the private schools. The height and weight of men in the mass are assumed to give a fair indication of their potential strength and energy. This assumption is confirmed by the results of actual tests made at Harvard and at other institutions in general strength and all-round athletics.

It will be observed by students in anthropometry that 69.5 inches in height and 145.5 pounds in weight represent very high averages for any large group of men not especially selected for their superior physiques. In this case, the conditions represent not only the influence of heredity, nurture, environment, and social selection, as we have stated, but also the influence of the physical training and athletics at our best private schools for the past 25 years. It is during the formative period of youth that they are the most susceptible to physical as well as to mental improvement.

The difference in the physical results shown by the pupils from the public and from the private schools measures to a large extent the possibility of physical improvement for which school authorities are to some degree responsible. The improvement that has taken place within the past dozen years in the physique of the pupils from some of our best public schools shows what may be expected from systematic attempts at teaching and practicing hygiene and physical training. The trend of the present development of physical training in most of our institutions of learning is toward the adoption of a wider range of sports, games, and physical activities, and of some plan to encourage more general participation in them. Our schools and colleges are increasing their facilities for more practice in out-of-door as well as in-door sports in both winter and summer. There is a growing inclination to establish regular departments of physical training, and to put all of the work on a rational, if not on an academic, basis, and place it under the direction of some central authority. This attempt naturally leads to a conflict between the advocates of the old and the new régime, or between the representatives of the spectacular and those of the educational and remedial aims of physical training. The spectacular aims, in which contests for records and for athletic superiority abound, appeal to the young of both sexes. These contests bring into prominence the special instructor, the trainer, the newspaper reporter, and the enthusiastic followers and admirers. This is the constituency that furnishes the gate receipts and the financial backing upon which success in spectacular athletics so much depends.

The educational aims of physical training are appreciated by psychologists and the more advanced group of educators; but too many would-be educators are trying to read into physical activities from the top, or from their inner consciousness, those fundamental principles in education which can only be learned from the bottom up, or from practical experience. Hence the almost constant friction between those who know the game and those who do not. Medical men are naturally the strongest advocates of the remedial aims of physical training, because they know better than any others the physiological and therapuetic effects of properly conducted physical exercises. Too many physicians, however, are prone to regard simple physical defects and deficiencies as of a serious nature, instead of a variation from the normal, and in their enthusiastic efforts to treat such cases would have the whole school or college converted into a hospital or sanitarium.

The crying need of the age is a universal recognition of the physical origin of the nervous system, with its dependent mental and moral life, and of the absolute unity and integrity of the human organism. Following this need is the pressing demand for instructors of our youth who have the combined training of the athlete or gymnast supplemented by as much of the special training of the pedagogue and physician or hygienist as it is possible to obtain in the period given over to preparatory education.

When the problems of public health and hygiene are better understood, when the individual realizes his responsibility for the application of the laws of hygiene to his own life, and the instructor in physical training prepares himself along the broad lines that have been suggested, we may look forward with reasonable hope of realizing a higher degree of health and efficiency among our people.

REPORT OF INVESTIGATION OF COLLEGE CATALOGUES.

The catalogues of 391 colleges, universities, and agricultural schools were carefully studied to ascertain the work which was being offered in the departments of physical training and of hygiene in those institutions. In the case of large universities, the college of liberal arts or of arts and sciences is referred to, unless otherwise stated, as normal school, school of expression, medical school, etc. In 38 of these catalogues no mention was made of physical training, military drill, athletics, or hygiene, although in one there was a picture of a boys' baseball field and in another a picture of a girls' basket-ball field. Of these institutions there were 14 Catholic parochial schools and 15 schools for instruction of colored people in agricultural and household arts. In 30 of the catalogues athletics and outdoor sports only were mentioned as the forms of exercise indulged in.

Forty-eight offered military science and tactics (which are required of all Government land-grant institutions), and of these, 5 had military drill and voluntary outdoor sports only, while in 41 some form of physical training also, either voluntary or compulsory, was offered. In some of them the physical training was for the women, while the men had military drill only. In 2 military science and hygiene were given. In a few of these universities and colleges there was no mention of gymnastics or physical training, but prescribed or voluntary courses in hygiene were offered, usually in connection with physiology and under the general topics of science or biology. Seven mention hygiene alone. Two mention hygiene and athletics. Two mention hygiene and military drill.

A certain class of colleges offered physical training only in connection with the normal school or the school of expression (usually for women). There were 10 of these, and in no case was the work well outlined.

There was next a large number of cases which were termed "doubtful," because, from the wording of the catalogue and the slight reference to the work, it was doubtful whether there was a regular department of physical training. Mention is sometimes made in the list of the faculty of a gymnasium or physical-culture director, or, under the description of buildings, the catalogue speaks of a "well-equipped gymnasium" or of "a room for gymnastic purposes"; or, again, it says that a new gymnasium is needed, contemplated, or in the process of construction. Just how important such types of cases are can not be known without individual investigation of the colleges. There were 39 of these doubtful cases; 6 of them, however, had departments of military science and tactics; 3 offered hygiene not connected with gymnastics, but in normal or medical, and 1 in general elective course. The next group clearly paid considerable attention to physical training, but the work, whether described as voluntary or compulsory, was not well defined. It was doubtful whether the department of physical training was well organized, with the work regular and systematic, and the requirements really enforced. These are the institutions with catalogues which read: "Regular class work in physical training is required of every student," but no definite number of hours and credits are scheduled; or, again, "A certain amount of work in the gymnasium is required of all students"; or, "Students are expected to take physical culture," and "gymnasium work is recommended, especially for freshmen." They often speak of well-equipped gymnasia, competent instructors, and a solicitous regard for the students' health and recreation. These institutions, in contrast with the group to follow, are called "ill defined." In this "ill-defined" group of 71 there were 44 which had no mention of a department of hygiene, although one of them offered elective courses for normal instruction in physical training.

As is shown in the table of the relation of hygiene to physical training in these institutions, the largest number offer courses (elective) in hygiene which are not connected with the department of physical training. These courses are usually allied with physiology, and come under that subject or under the general head of biology, but they are all included in the regular curriculum of the college and, like any other college elective, usually carry credits. In six of them we find instruction in hygiene compulsory, but not connected with physical training. Many of these are women's colleges, and, in almost all cases, the requirement is to be met in the freshman year or by all new students. As might be expected in those institutions where physical training is not well defined, no case is found where hygiene is connected with physical training and is compulsory. In contrast to this, there is a large group (53) of cases where physical training is well defined, and hygiene is connected with it and is compulsory.

The last group is that in which the department of physical training was well defined and numbers 187. Evidence was given in the catalogues of these colleges and universities that the work in physical training was well organized and given a regular defined place in the curriculum, with time and hours apportioned to it in the schedule. The work was either voluntary or compulsory (with a majority compulsory, two hours a week for two years), but in both cases systematic and progressive courses were arranged. In some of these institutions the work was compulsory for women only, physical training being replaced by military tactics or athletics for the men. In others, on the contrary, it was voluntary or compulsory for men, no suitable provision as to gymnasium and field work being made for the women. But there were in most cases facilities for both men and women, indoors and out.

In many instances mention was made of added equipment, new gymnasia, extended athletic fields, or recreation grounds, and in all these institutions there was a general feeling that the physical training of the students was a vital part of the curriculum. In this group (always, when the work was compulsory, and often, when only voluntary) mention was made of thorough physical and medical examinations, charts, records, and systematic oversight of health, and correction of individual defects. There were usually separate instructors for men and women, although, in a few small coeducational colleges, a man taught them both. Likewise, the catalogues speak of separate gymnasia for men and women, the women's being in their dormitory or hall, while the regular gymnasium is reserved for men and is used also as an armory for military drill or as a practice hall for athletics.

The following table will show the relation of hygiene to physical training in both types of institutions, in those where physical training is well defined and in those where it is ill defined:

	Well-defined department of physical training.	Ill-defined department of physical training.	Totals for hygiene.[1]
No hygiene	5 normal 59	1 normal 44	103
Hygiene compulsory and connected with physical training	10 normal 53	0 normal 0	53
Hygiene voluntary and connected with physical training	9 normal 3	0 normal 2	5
Hygiene compulsory and not connected with physical training	5 normal 28	0 normal 6	34
Hygiene voluntary and not connected with physical training	4 normal 33	1 normal 15	48
Hygiene connected with department not arts and sciences	4 normal 11	0 normal 4	15
Totals for physical training	187	71	258
Doubtful physical training	39	....	....
Hygiene not connected with physical training	4	....	....

[1] 155 of the 258 offer hygiene.

As is to be expected, in the "well-defined" group we find the largest number of colleges and universities offering normal instruction in physical training. Catalogues do not always say distinctly whether such training includes all departments of theory and practice, so it is to be supposed often that merely teachers' courses in practice are offered. This normal elective work is sometimes a direct continuation of the prescribed work, and sometimes constitutes a separate course. As in previous cases, when hygiene is elective and not connected with physical training it is a general college elective under physiology or biology, and when compulsory, but not connected with physical training, it is usually for freshmen and all new students. In some cases there are, besides the hygiene given in the physical-training department, elective courses also in sanitation, public and domestic hygiene, and advanced personal hygiene in the regular college curriculum, while in nine cases we find hygiene connected only with home economics, normal, medical, or some course not in the department of arts and sciences.

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[1] See supplementary report.

GENERAL ELEMENTARY TRAINING IN HYGIENE IN PUBLIC AND PRIVATE SCHOOLS.

JOHN W. RITCHIE, College of William and Mary, Williamsburg, Va.

Man appreciates that which he understands; he disregards that which lies outside the range of his knowledge. The members of this Congress regard hygiene as important because they have studied it and realize the possibilities there are in it for mankind. School authorities and teachers, generally speaking, lack the special knowledge that would give them an appreciation of the discoveries of modern hygiene; notwithstanding the splendid work that a few of them are doing for health, most of them are not interested in the subject. We find, therefore, that they give little attention to the questions which we have met to discuss—that the elementary schools of Europe are making no attempt to give systematic instruction in hygiene, and that, in the United States, according to the best statistics available, the average child who finishes the eight grades of the elementary school devotes only from two to three weeks of school-time to what is called physiology and hygiene. Our colleges are coming to an understanding of the value of the physical man, but in our educational practices in the elementary school grades we are still governed by the ideas of the medieval monk who regarded the corporeal part of his being as an encumbrance that must of necessity be borne while he pursued the affairs of the spirit.

In the teaching of hygiene in the schools I would therefore say, first of all, that the subject must be presented in such a way that school authorities, teachers, and parents will be made to understand the benefits that follow an understanding and an observance of the laws of health. The first step of all is to kill in the minds of these persons the age-old notion that disease comes as a dispensation of Providence; to implant the idea that health is a commodity that can be earned and purchased. In impressing these ideas I have found nothing so effective as simple explanations of the great causes of disease and comparative morbidity and mortality rates. Charts showing in a graphic way the great diversity of death rates in different countries and cities are exceedingly valuable in convincing those responsible for school curricula that the amount of sickness and the number of deaths in any community depend on the intelligence that the people use in dealing with matters of health.

The second point that I would make is that the courses in hygiene in our schools should be organized in a systematic way and the subject taught in a formal manner. The structure of the body ought to be studied, the workings of its different parts made clear, the great laws of nutrition explained, and the nature of disease germs and parasitic infections set forth. Hygienic practices should then be taught as corollaries of the physiological propositions that have been established. I am aware that many hasty utilitarians object to spending time on these fundamentals and advocate the teaching of the rules of hygiene without the physiological principles that underlie them. The trouble with this method is that teacher and pupil alike become lost in a maze of details; that the teaching lies but lightly on the pupil's mind because the reasons for it are not understood; and that the pupil is left resourceless in the many new and complex hygienic experiences which life must inevitably bring to him. The fact that the people of the United States yearly pour more than a hundred million dollars' worth of patent medicines in among their delicate, sentient cells; that we have organized antivaccinationists actively fighting some of the most beneficent medical discoveries of the ages; that hundreds of persons are willing to take up fasting practices and food fads without thought as to how the hoped-for benefits are to be brought to their bodies; that in a country like Germany quackery has been able to increase 1,600 per cent in 33 years; that a reputable medical practitioner often receives no more public consideration and no larger income than the weaver or the blacksmith who elects to ply the healing art; that people everywhere are willing to intrust their very lives to impostors who promise to cure them with everything, from occultism to green electricity; surely facts like these make it plain that our courses in hygiene should be of such a character that when the pupil has completed them he will have a general understanding of the laws of physical life, some guiding principles that will enable him to judge for himself as to what is reasonable and probable in the world of health. Cells and protoplasm and a compound microscope have a natural right in an elementary course in hygiene, because hygienic dogma, taught by rule-of-thumb methods and fragmentary study of isolated topics, can not give the background of general intelligence as to matters of health that is so important for the people to possess.

But while a scientific foundation for hygiene ought to be given by systematic classroom instruction, it is equally important that hygiene be informally taught in every possible way. Shakespeare remarks, "I can easier teach twenty what were good to be done than be one of the twenty to folow mine own teaching," and in the hygienic, as well as in the ethical world, practice ever tends to lag behind precept. It is not enough, therefore, that the dangers of the public drinking cup should be explained to the pupils, but the cup must also be banished from the school. It is essential that the pupil should be taught how important sound teeth are, but the matter should not rest at this point. He should be urged to keep his own teeth clean, and, if they are in need of dental care, he should know that it is a matter of concern to the teacher and to the school authorities. Taken alone, this kind of teaching is unsatisfactory, because the pupil does not understand the reason for many of the hygienic rules brought to his attention, and he is more likely to be convinced that his teacher is a crank than that his health is important or in danger. Coupled with a systematic course in the theory of the subject, the value of this phase of the work can hardly be overestimated. It translates theory into practice and bears the same relation to the classroom recitations that the laboratory work in a science course bears to the recitations and lectures. One of the most efficient instruments ever devised for the preservation of health is medical inspection of school children, and if this could be linked with a course on the theory of health and made to include the correction of defective habits of life as well as defective parts of the body, the teaching of hygiene in the schools would be placed upon a basis almost ideal. In this informal work, however, it is very necessary that what is done in the name of hygiene shall be centered upon that which is big and vital in the conservation of health. The care of finger nails may well be insisted upon from the point of view of cleanliness, but by emphasizing and exaggerating the hygiene of this point it is easy to leave the impression that, as a profession, manicuring ranks above medicine.

Another point of importance is that the teaching of hygiene should be begun early in life, before the habits of living are formed. Ordinarily, nothing short of a total collapse of the health will cause an adult to change his hygienic habits; his ways of eating, sleeping, working, and regulating his local environment. Even some of the world's authorities on hygiene daily violate some of the rules they lay down for the guidance of the public, because they formed their habits of living before they acquired their knowledge of the laws of health. The teaching of hygiene should be begun while the child is yet in the plastic stage, so that he may be sent out from school with a physical expression of his instruction in the habits of his life.

Finally, your speaker would like to give it as his opinion that the causes of specific diseases and the methods of preventing these diseases should be definitely and concretely taught. Objection is made to this method by those who insist that it is a mistake to put ideas of sickness into children's minds, but those who make this objection do not seem to realize that the abiding ideas of disease and death that disturb the childish mind come not from anything that is read in books, but from personal experience on beds of sickness; from first-hand knowledge of the suffering of members of the family; and from the sudden vanishings of brothers, sisters, parents, and playmates. As long as sickness is in the lives of children it must be in their minds, and the way to put it out of their minds is to banish it from their lives. We can not have our children escape all thought of ill health by merely failing to give them information about the sickness that is all about them, and, since a knowledge of the truth will enable them to escape much of the suffering that must otherwise come upon them, they should be warned of the dangers that they must encounter. To do this it is absolutely necessary that we give the public specific information about the diseases from which they suffer, and the only way of getting this knowledge to the people as a whole is through the great school system that has been founded for their instruction. In all my experience I have never seen a single child injured by teaching of this kind, and, after careful investigation, I am convinced that the opposition to it, which in certain localities is very intense, is based on sentiment and not on fact.

To recapitulate, in the teaching of hygiene facts ought to be presented that will show the possibilities of health that are now open to our race; a solid physiological foundation for the laws of hygiene should be laid; health points should be informally emphasized in the classroom whenever it is possible to do so; the teaching should begin before living habits have become fixed, and the pupil should be warned of the specific diseases and the dangers that he may encounter.

THE VALUE OF POPULAR LECTURES IN THE EDUCATION OF THE PUBLIC IN PERSONAL HYGIENE.

Rosalie Slaughter Morton, M. D., New York City.

The need for education by means of lectures and much of the valuable work which has been done toward educating the public in personal hygiene has been so ably set forth by the speakers who have preceded me in this symposium that I shall confine myself to a brief and practical summary of the national work in public health education, which has been going forward under the guidance of the American Medical Association since June, 1909.

One of the constructive features of a congress is the bringing together of people interested in similar work to compare methods and results and to keep informed regarding each other's plans and purposes.

The average illness to-day in the United States is equal to 10 days' incapacity for each individual. It is therefore urgently necessary that we work together, for all we can all do will be needed to materially lower this total of largely preventable inefficiency.

The plan of organization of the American Medical Association for public-health education among women is the formation under the American Medical Association in the county medical societies throughout the United States of committees on public health education, of which the one under New York County may be taken as a type.

Through this committee in the New York Academy of Medicine for the last three winters a series of 12 lectures have been given on alternate Thursday afternoons and Wednesday evenings to men, women, and children of all classes of society. The wide public interest which has been shown in the presentation of plain facts regarding health is shown by the fact that the seating capacity of the hall is 375 persons, and on every occasion the adjoining rooms had to be thrown open. Frequently there has not been standing room, the average attendance being 500. One evening the number reached 1,000, and it was necessary to have an overflow meeting in another part of the building. A general recognition of the value of knowledge tending to build up the individual and community standard of health was shown by the fact that workingmen in flannel shirts sat next to society women. Bank clerks, moving-picture operators, clerks of all kinds, members of women's clubs, school-teachers, Young

Women's Christian Association, and Young Men's Christian Association workers, Sisters of Charity, members of the Salvation Army, social settlement workers, New York college professors, as well as people from surrounding towns, all came to these lectures.

The secret of the success of the lectures was that each member of the audience was made to feel that he or she was a vital part of the educational campaign. Many people have come for the whole series for three years; many clubs and other organizations have arranged their programs to cooperate with the "academy lectures," as they are called. Some schools required their scholars to take notes and gave them class credits accordingly. A high school and several private schools dismissed their classes so that both pupils and teachers could attend.

The lecturers are all members of the Medical Society of the County of New York. The subjects, free from technicalities, presented there and in other county medical societies throughout the United States are:

1. Conservation of our greatest natural resource, the health of the people.
2. The educational value of pain.
3. Food; its relation to intellectual and physical development.
4. Food values.
5. Care of food in the market and the home.
6. Restaurant inspection.
7. The relation of clothing to physical and moral health.
8. The value of rest and exercise to health.
9. The causes and prevention of nervousness.
10. The relation of pure water to public health.
11. The common drinking cup.
12. The air we breathe and the value of ventilation.
13. Sanitation of the home.
14. The sanitation of street cars and other public conveyances.
15. Open-air schools and healthful school buildings.
16. The importance of medical inspection of public schools.
17. The relation of clean streets to public health.
18. Pure milk and infant hygiene.
19. Care of the growing child.
20. Habit postures, good and bad.
21. The relation of home and school to the health of the child.
22. The relation of children's amusements to health.
23. The ounce of prevention.
24. Bacteria, helpful and harmful.
25. The prevention of Fourth of July injuries and tetanus.
26. The cause and prevention of colds, bronchitis, etc.
27. The care of nose, throat, and ears.

28. The relation of adenoids, tonsils, and teeth to health.
29. Care of the eyes and prevention of blindness.
30. The relation of flies, mosquitoes, etc., to public health.
31. Prevention of some of the commoner skin diseases.
32. How to meet emergencies—hemorrhage, burns, and the like.
33. The care of contagious diseases.
34. The prevention of tuberculosis.
35. Cleanliness—moral, mental, and physical.
36. Causes and prevention of immorality among children of high-school age.
37. How to instruct children in regard to the origin of life.
38. Necessity for parent instruction in sex hygiene.
39. The responsibility of girlhood to womanhood (for girls).
40. The responsibility of boyhood to fatherhood (for boys).
41. Eugenics.
42. The value of early diagnosis of cancer in women.

Several of these are combined, or the various phases elaborated, as shown by the accompanying sample of program:

[Medical Society of the County of New York, public health education committee, 17 West Forty-third Street.]

Course of Lectures on the Prevention of Disease.

THE HYGIENE OF FOOD.

Wednesday, January 10—8.15 p. m.—Common food adulterants and their effect on public health, Harvey W. Wiley, M. D. Common sense in diet; combinations to avoid, Mary M. Crawford, M. D. Hygiene of nutrition: Causes and results of chronic dyspepsia, Henry P. De Forest, M. D.

ALCOHOL IN RELATION TO EFFICIENCY.

Thursday, January 18—3.30 p. m.—Alcohol, a menace to the soldier, the privileges of the post exchange, Louis Livingston Seaman, M. D. Alcohol in relation to stomach and liver, Margaret York, M. D. Alcohol and the individual, Harlow Brooks, M. D.

EFFECTS OF HOME MEDICATION.

Wednesday, January 24—8.15 p. m.—Dangers of indiscriminate drugging, Alexander Lambert, M. D. The care of the convalescent, Mary Willits, M. D. Useful forms of medication, M. Solis Cohen, M. D.

CONTAGIONS AND THEIR PREVENTION.

Thursday, February 1—3.30 p. m.—The body's defense against disease, William H. Park, M. D. The use of vaccine to prevent and cure disease, Martha Wollstein, M. D. The use of serum to combat disease, Simon Flexner, M. D.

SEX HYGIENE FOR MEN.

[Only men will be admitted to this lecture.]

William M. Polk, M. D., presiding.

Wednesday, Feburary 7—8.15 p. m.—The prevalence and significance of venereal diseases, Prince A. Morrow, M. D. Moral problems of college life, Seneca Egbert, M. D. What a father should tell his son, Ira S Wile, M. D.

CHILD HYGIENE.

Thursday, February 15—3.30 p. m.—The prevention of the commoner contagious diseases in early life, Royal S. Haynes, M. D. The duty of the community to its backward and defective children, Isabelle Thompson Smart, M D. Outdoor life for city children, Walter Lester Carr, M. D.

COLDS.

Wednesday, February 21—8.15 p. m.—Common colds, Abraham Jacobi, M. D. Fatigue in relation to colds, Grace N. Kimball, M. D. The neglected cold, John B. Huber, M. D.

TRIUMPHS OF MODERN SURGERY.

Thursday, February 29—3.30 p. m.—Asepsis and antisepsis, George D. Stewart, M. D. What anesthesia has done for surgery, Mary Dunning Rose, M. D. The time to operate, George E. Brewer, M. D.

SEX HYGIENE FOR WOMEN.

[Only women will be admitted to this lecture.]

Wednesday, March 6—8.15 p. m.—What a mother should tell her child, Mary Sutton Macy, M. D. Instruction of college students in regard to reproduction and maternity, Elizabeth B. Thelberg, M. D. Sex hygiene in relation to eugenics, Isabelle Delany-Barbour, M. D.

CARE OF THE EYE AND EAR.

Thursday, March 14—3.30 p. m.—Inflammatory conditions of the eye, Edward S. Peck, M. D. Eye strain, Frank Van Fleet, M. D. Catarrhal conditions of the ear, Grace G. Prior Yankauer, M. D.

NERVES IN THEIR RELATION TO EFFICIENCY.

Wednesday, March 20—8.15 p. m.—Unfounded beliefs concerning insanity, M. Allen Starr, M. D. Functional disorders in relation to nervous exhaustion, Rosalie Slaughter Morton, M. D. Overwork and fatigue in relation to nervous prostration, Edward Livingston Hunt, M. D.

CAUSES AND PREVENTION OF PELVIC DISORDERS.

Thursday, March 28—3.30 p. m.—The causes and results of constipation, George Gray Ward, jr., M. D. The care of the health in the menstrual period and the menopause, Angenette Parry, M. D. The hygiene of pregnancy, Edward Bradford Cragin, M. D.

These lectures are open to the public; no cards are required.

We have found that the best way of obtaining results is:

I. To have especial attention paid to the ventilation of the hall, as an accumulation of carbon dioxide in the air makes it impossible for people to listen attentively.

II. To arrange to have each speaker limited to 20 minutes and requested to make a few clear points, as the change of voice and personality of the speakers will hold the attention and accentuate different phases of a subject better than when one speaker covers the same points in an hour, because the auditory nerve unconsciously becomes fatigued by the same inflections of voice.

III. To request the speakers to compare their addresses, so that there will be no repetitions and no contentions, the object being to give to the audience a constructive idea of the subject presented, which shall be helpful on broad lines.

IV. To use charts and objects as illustrations, to demonstrate simple home measures for health and hygiene, to have lantern illustrations limited to 20 minutes in one symposium, to avoid fatiguing the eyes and consequently the rest of the body.

V. To encourage the audience to ask questions of general application and to answer them frankly, fully, and cordially, each speaker answering the questions upon the subject of his or her paper.

VI. To treat all questions seriously, with a spirit of encouraging those who have health superstitions to voice them and be told the truth.

VII. To make a custom of repeating the question, so that the answer may be clearly understood in its relation to the interrogation, and that nervous and uneducated members of the audience may feel free to ask questions, knowing that in a tactful and kindly way the sense of their questions will be repeated without the clumsy wording.

VIII. At the end of each course to ask the audience, by unsigned slip ballot, to indicate subjects which will be most helpful to them, so that the 12 with the highest vote can be put on the next program.

IX. The sense of personal responsibility of the audience is aroused by their realization of the practicability of the work, and that it is absolutely altruistic in nature. They know that the lecturers are people who are exceptionally busy with the immediate demands of the acutely ill, and that, in order to have this work of precaution as wide reaching as it should be, they must use the knowledge gained for themselves, their children, and also in whatever group work they are interested in developing.

The Mothers' Club of New York City has, in consequence of the interest aroused by the academy lectures, made its entire program of meetings for this winter relate to education regarding the mental, moral, and physical health of children.

During the first year of the New York County Medical Society lectures, which are part of the American Medical Association education campaign, they were the only series in the city. In the following year there were six similar series going forward under other agencies, with no diminution of attendance at the Academy of Medicine. Among work partly stimulated by the labors of this committee is the campaign in sex education now going forward under the New York State Department of Health, which incidentally, is a remarkably courageous and public spirited official step to be taken by a department of health, and one which we hope will be widely followed.

The absolutely cordial relation between this and similar efforts looking to health betterment in New York City is one of the best features of the work, and the 1911–12 yearly report of the national work shows active cooperation with 67 organizations and numerous plans for extending the work.

A general feeling of comradeship exists in all of the 48 States, the District of Columbia, Alaska, Hawaii, and Panama, where the work is now going forward, and a total of about 10,000 lectures have been given in English, German, Russian, Polish, Yiddish, and Italian. The aggregate number of people present at lectures was over 600,000, a considerable number of these being children, for, as Dr. Eleanor Seymour, our California State chairman, says:

> Many of the older generation have been anesthetized by repeated monotonies, and it is in the plastic, receptive minds of the coming generation that the seeds of hygiene will bear richest fruit. It is easy to start a child right. He accepts and assimilates new truths, and these, becoming a part of his composition, find practical expression in adult life.
>
> To many grown-ups the introduction of sanitary science seems an intrusion. They have survived primeval customs and conditions. Why disrupt them? The children are, therefore, the sanitarian's greatest asset, and the improvement of their condition is the work of the century. This necessitates the education of their superiors in the science of right living, for in this movement for health conservation parent, teacher, and child are vital and inseparable factors.

Dr. Eleanor Everhard, of Dayton, Ohio, the present national chairman of the committee, says:

> I am more and more impressed with the truth of the fact that it is the individual who must be taught. When the individual knows what is required for his own physical safety and well-being he will object to the careless and dangerous habits of his neighbor, and personal hygiene immediately become civic hygiene. The object of this committee is to teach the individual, by any method which is interesting to him, on any subject which will protect him from disease. Methods differ in different States, because people differ in different States.

The map on the opposite page shows the distribution of centers; 2,000 of the 30,000 members of the American Medical Association, about an equal number of women and men, are actively working with this committee:

The value of popular lectures is indirect as well as direct:

I. Interest has been stimulated by prizes offered for the best essays written on public-health subjects, as in North Carolina.

II. Our committee has helped to secure medical inspection in schools in several localities.

III. The opening of more playgrounds, as in Dubuque.

IV. It has selected a traveling shelf of books on the prevention of disease.

V. It has compiled and published a comprehensive list of books on personal hygiene in all its phases.

VI. It has secured better ventilation of the street cars in certain cities.

VII. It has been granted the appointment of a health day by the governors of several States, to be observed annually, as in Georgia.

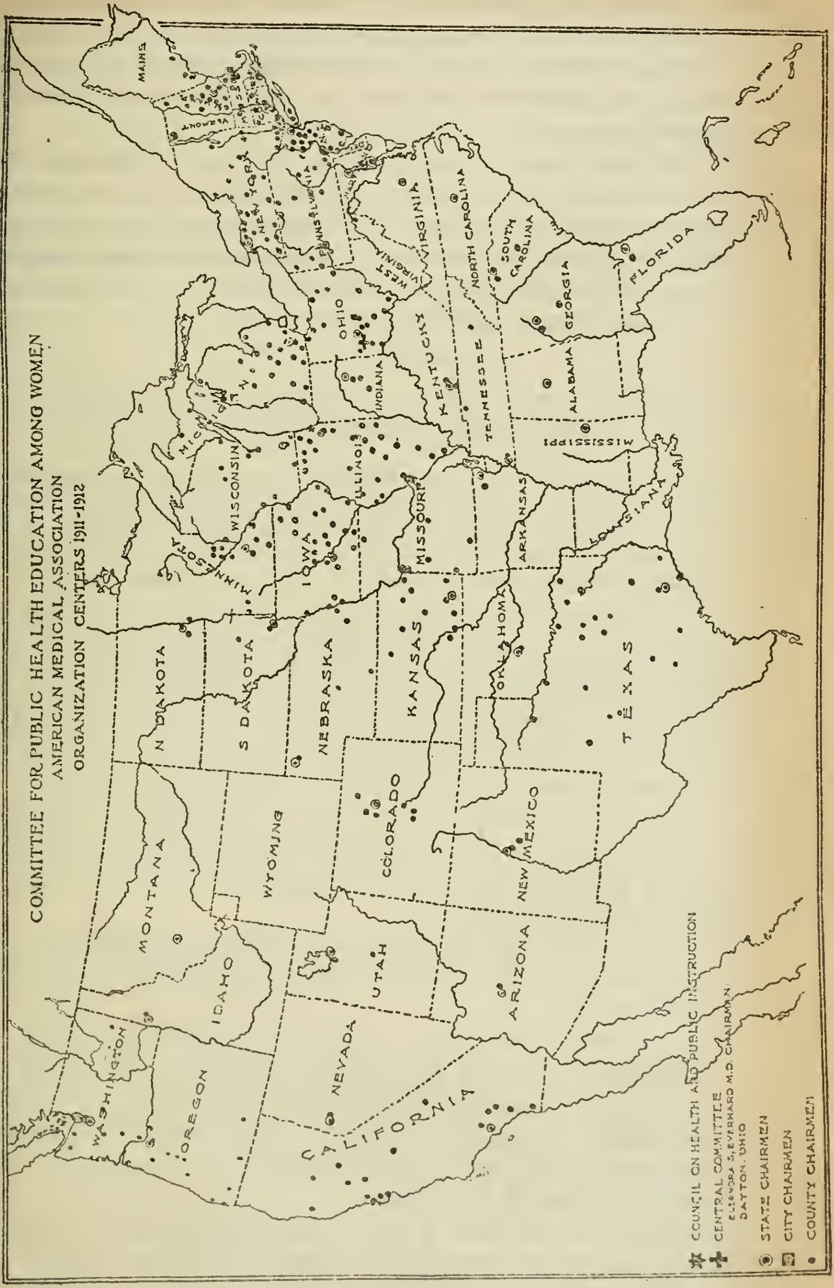
VIII. It has established courses of lectures in connection with clinics, as at the woman's clinic in Washington, D. C.

IX. It has made education so popular that one woman asked for a book on tuberculosis to take home to read to her husband in the evenings, and one little girl, 5 years old, arranged her playmates in a row and lectured to them on health.

X. A method of public instruction used in Iowa was converting a baby beauty contest into a baby health contest. The children entered in the contest are divided into classes, according to age and to the environment from which they come. The score card, in accordance with which they are examined contains statistics for the healthy child, and the reverse of the card contains items of instruction for the parents. From the Iowa State Fair just passed, it has been discovered that Iowa babies measure above normal. They hope within two or three years to give the average of a thousand babies, with the conditions in which they have been reared. Hundreds of score cards with information are distributed. In addition, talks are given daily in this department of the State fair. Two hundred and thirty-six babies were measured. More were entered but failed to appear. The winner in the 2 to 3 year old girl rural contest this year was entered in the 1 to 2 year old class last year and failed. Her mother learned wherein she was deficient and brought her up to normal by care in regard to diet, etc.

XI. In those States which have been visited with special epidemics during the year instruction has been given to the public in the prevention and quarantine of those diseases.

XII. In many States the newspapers are being used as a medium of communication and distribution of accurate information.



XIII. In other places the county committee for public-health education, working with the librarian in the public library, reviews all the popular books on hygiene on the library shelves, relegating to the back shelves those which are sentimental or out of date, and publishing for the benefit of the public lists which are authoritative.

XIV. The efforts in each community are to teach the people how to prevent those diseases which are preventable, bearing in mind always that it is the individual we wish to reach, as communities can not be educated en masse.

I regret that time does not permit me to do greater justice to the extensive and entirely gratuitous work which has been done by many physicians, who have worked with unfailing generosity, and whose work, together with that of the many philanthropists whose work is so well represented at this congress, will, I believe, be a substantial contribution to the life-saving work of the world.

LE PROBLÈME DE L'ÉCLAIRAGE, DE L'AÉRATION ET DU CHAUFFAGE DE LA CHAMBRE À COUCHER ET SA SOLUTION.

A. Augustin Rey, Membre du Conseil Supérieur des Habitations (Ministère du Travail) ; Membre du Conseil Supérieur de la Petite Propriété Rurale Ministère de l'Agriculture) ; Membre Correspondant de la Commission Internationale contre la Tuberculose; Délégué du Gourvernement Français au Congrès International de la Tuberculose de Washington en 1908.

On ne saurait attacher assez d'importance à fixer d'une manièra rationnelle les éléments qui doivent constituer la chambre salubre.

Il ne s'agit pas ici du local familial où l'habitant peut exercer une profession, ni des pièces de parade où les membres de la famille ne passent que quelques heures du jour, ni des locaux de passage qui n'ont qu'une destination temporaire dans les logements.

Dans ce groupement d'espaces clos qui s'appelle le logis, la chambre est comme l'alvéole dans la ruche d'abeilles, elle est cette cellule centrale autour de laquelle toutes les autres gravitent et où la plus grande partie de la vie se passe.

Il est difficile de faire dans l'habitation salubre la démarcation très nette entre la chambre qui sert de jour et celle utilisée seulement pour y coucher la nuit.

La complexité de la vie moderne dans les agglomérations, pour toutes les classes laborieuses de la société, a fait monter le logement à un prix si élevé que le plus souvent la même pièce abritera de jour la femme et les enfants du ménage et verra la nuit la famille y dormir. Cet état lamentable, conséquence des conditions économiques de la vie des sociétés, a faussé le problème.

Ces considérations montrent à quel point l'hygiéniste se trouve angoissé lorsqu'il s'agit de donner une formule satisfaisante pour la construction de la chambre salubre. Doit-il, dans ces conditions, hésiter à porter la pioche et le marteau destinés à faire s'écrouler les

vieilles formules et combattre les routines séculaires, en apportant les réformes nécessaires aux habitudes antihygiéniques contractées dans l'agglomération moderne? Doit-il se récuser en continuant à patauger dans les solutions mixtes qui n'apportent aucune amélioration à la science de la construction. Faut-il, comme tant d'autres l'ont fait avant lui, continuer à empiler une documentation stérile d'avance et dont le résultat est de le tirer habilement d'une situation qui semble sans issue?

Nous ne le pensons pas. Nous estimons que l'architecte doit devenir avant tout le premier hygiéniste du monde en cherchant à résoudre successivement chacun des éléments dont se compose l'habitation et dont la chambre est le premier de tous. Il doit refaire le bloc habité d'une salubrité incontestable. Ces travaux n'ont jamais été faits avec le sentiment professionnel de haute responsabilité qui lui incombe.

L'hygiène de l'habitation a été trop souvent l'objet de complications par des auteurs, soit médecins, soit hygiénistes, soit théoriciens, n'ayant aucune capacité technique précise. Ce qui a causé l'encombrement dans la bibliographie moderne relative à l'hygiène de l'habitation ce sont les redites, les formules toutes faites inexécutables, les à peu près scientifiques. C'est cette absence en un mot de la double qualité à la fois des techniciens exécutant directement des bâtiments, par conséquent rompu à toutes les questions d'exécution pratique, qui se présentent à chaque pas dans la construction, et les savants au courant des découvertes scientifiques les plus récentes, qui ont enrayé le progrès. Il faut être enthousiaste des répercussions pratiques que la science moderne fait naître à chaque pas lorsque l'on sait la comprendre et l'appliquer.

Cet espace qu'est la chambre qui n'a pour but que de protéger ceux qui l'habitent contre les intempéries et l'action direete des vents doit, dans toute la mesure du possible, emprunter à la vie en plein air ses conditions essentielles, lumière en abondance venant de partout, renouvellement constant de l'air en contact avec nos organes.

En plein air on est plongé en effet comme dans un bain de lumière et d'air sans cesse renouvelé.

Telle qu'elle est généralement construite, la chambre actuelle répond-elle à ces conditions primordiales?

Le flottement que nous constatons partout nous montre qu'il n'en est rien et qu'aujourd'hui on est encore à discuter le mode d'éclairage, d'aération et de chauffage qui conviennent pour la chambre salubre.

On ne saurait assez se pénétrer de cette idée que les dimensions données à la chambre et la constitution de ses différents éléments: planchers, parois verticales, plafond, fenêtres, portes, placards, ameublement même, ont une importance capitale pour l'hygiène de l'habitation. Jusqu'en ses moindres détails, tout doit concourir à rendre parfaits son éclairage, son aération et son chauffage.

Après avoir fait une analyse minutieuse au point de vue des nécessités de l'hygiène des différents éléments qui constituent la chambre, nous pourrons, par leur synthèse, arriver à reconstituer ce que doit être la chambre salubre.

Cette reconstitution semble n'avoir jamais été obtenue jusqu'ici par une méthode scientifique. Et c'est ce qui fait que l'habitation réellement saine reste toujours discutée.

La chambre est l'element d'importance fondamentale auquel tout dans l'habitation doit être d'abord subordonné. C'est d'elle que dépend en définitive le logement, la maison, le quartier, et enfin la ville.

On peut se demander comment on a pu si longtemps négliger cette étude. Comment on a pu bâtir des milliers de villes dans lesquelles des millions de chambres ont été construites, sans en définir hygièniquement, dans leurs termes généraux, les principes fixes.

Les dimentions de la chambre dans le logement méritent d'être étudiées de très près.

Nous sommes partisan de laisser à la chambre en général la forme rectangulaire.

Sans prendre parti ici pour telle ou telle conception des formes générales de la chambre qu'il convient d'adopter au point de vue des habitudes locales, il n'est pas contestable qu'au point de vue général il semble, néanmoins, indispensable de laisser à celle-ci des formes simples, toujours les plus hygièniques, et ayant l'avantage, pour l'ameublement de la pièce, de se disposer commodément et sans perdre de place.

A cet égard, la forme rectangulaire, adoptée généralement par l'architecture française, semble l'emporter sur les formes plus ou moins tourmentées préconisées à l'étranger.

Le prétexte inavoué de ses formes irrégulières a été de chercher trop souvent à dissimuler l'emplacement du lit. Cette forme de l'architecture domestique, qui a pris le nom d'alcôve, et qui a, peut-on dire, infestée tant de contrées, a porté une atteinte indiscutable à la salubrité de la pièce.

Il est acquis de nos jours que le lit doit occuper l'espace le plus dégagé de la chambre, de manière à être pour ainsi dire, constamment baigné dans la journée de toutes parts par la lumière et l'air.

La chambre est faite avant tout pour contenir des lits depersonnes adultes ou d'enfants. Il faut donc, en toute logique, se préoccpuer, pour em fixer les dimensions, du nombre de lits ou de personnes qu'une chambre minimum peut hygiéniquement contenir. Il serait, semble-t-il, utile également de déterminer aussi par avance la place des meubles indispensables. On n'y pense guère, et il arrive trop souvent que les portes, percées n'importe où, rendent le placement même des lits presque impossible.

C'est ici qu'intervient dans le calcul l'élément principal: La hauteur de la chambre qui a une influence énorme sur ses qualités fondamentales, l'éclairage.

Lorsqu'on parle au point de vue de la science hygiénique des dimensions d'une chambre, il ne faudrait pas oublier, comme on le fait généralement, que ces dimensions se composent de trois chiffres qui en fixent non seulement la surface mais encore le cube.

Les dimensions de la chambre salubre devraient toujours être rapportées à la quantité de rayons lumineux qu'elle doit recevoir. C'est donc par rapport aux éléments qui fixent l'ouverture d'où vient la lumière extérieure, a cette unité de lumière, que les trois chiffres de la chambre doivent être fixés. En d'autres termes, c'est en fonction de l'éclairage que la formule de la chambre salubre doit être exprimée. Ceci est nouveau, car jusqu'ici on a parlé surtout d'aération et passé à côté du vrai problème à résoudre qui est celui de l'éclairage, comme on le verra. Nos travaux sur ce suject ont un caractère révolutionnaire et ne tendent à rien moins qu'à transformer de fond en comble l'architecture misérable des villes actuelles.

Qu'on nous permette ici de rectifier une fois pour toutes la terminologie défectususe qu'on emploie généralement lorsque l'on veut désigner les deux dimensions qui déterminent la surface d'une pièce. Au lieu de: La largeur de la chambre; la longueur de la chambre.

Il faut dire: La façade de la chambre; la profondeur de la chambre.

On comprend ainsi d'emblée que le terme " La façade de la chambre " veut dire le côté par lequel elle prend lumière et air, et que le terme " Profondeur de la chambre " exprime le sens perpendiculaire à cette façade.

Comme nous le verrons il y a donc une relation étroite, qui est comme le coefficient hygiénique de la chambre entre sa façade sa profondeur et sa hauteur. Ce qu'on appelle couramment le cube d'air d'une pièce salubre est le résultat de la bonne harmonie entre ces trois dimensions. Il ne suffit pas, cependant, comme on le croit généralement que le cube soit vaste pour qu'une chambre soit salubre.

Il doit exister un rapport qui ne doit jamais s'écarter d'une certaine moyenne, entre le cube de la chambre et son coefficient d'éclairage diurne, sous peine de descendre au rang des locaux insalubres.

Dans nos climats tempérés la hauteur de la chambre nous semble devoir être fixée, non suivant les nécessités de l'aération, comme on l'a toujours dit sans contrôler la valeur de ce terme, mais surtout, et principalement, en satisfaisant aux exigences primordiales de l'éclairage, base essentielle de la salubrité de tout local clos et ouvert, dans lequel des êtres humains sont appelés à vivre.

Qu'on nous permette ici de protester contre l'emploi inconsidéré d'un terme cité à tort et à travers dans tous les traités d'hygiène et dans tous les ouvrages qui traitent de la salubrité de des habitations; celui de la ventilation. Il ne s'agit pas du tout de faire traverser les locaux habités par les vents extérieurs, dont la violence est parfois sauvage, atteint une vitesse excessive et n'est rien moins que nécessaire. Le mot vent répond trop à l'idée d'une atmosphère faite avant tout de brutalité pour pouvoir être introduite dans la maison sans inconvénients. Il s'agit non pas de ventilation, mais d'aération, c'est-à-dire de renouvellement d'air, dans des conditions de continuité et d'harmonie toutes différentes. Il est donc plus scientifique, au lieu de ventilation de la chambre, de dire "Aération de la chambre."

L'aération automatique, sans recours à acun appareil spécial, a été l'objet de tout temps de recherches opiniatres. On a passé à côté de la solution, car l'erreur a été de séparer l'aération de l'éclairage et du chauffage, or, comme nous le verrons, nos travaux ont consisté à répondre à la fois à ces trois termes de la salubrité qu'il est facile d'assurer dans une chambre lorsque l'on veut bien en établir d'une manière scientifique les formes. Pour satisfaire dans des conditions moyennes à un renouvellement normal de l'air d'une pièce, il suffit, en tout cas, à l'extérieur d'ouvertures de surfaces relativement restreintes.

Pour l'éclairage, le problème est beaucoup plus délicat. Il n'a jamais été abordé jusqu'ici. avec cette rigueur scientifique que comporte l'importance considérable, au point de vue hygiénique de sa solution.

La simple circulation d'air à établir, pour avoir une bonne aération, n'est pas étroitement dépendante, comme pour la lumière. Des trois dimensions de la pièce. Tandis que pour réalizer le maximum de pénétration dans la chambre des rayons lumineux venant de l'extérieur, il est essentiel que la hauteur de la pièce soit en rapport harmonique avec sa façade et sa profondeur. Les rapports qui doivent régir ces trois chiffres sont des plus importants à bien établir, et c'est de leur équilibre parfait que découlera le succès hygiénique final.

THURSDAY AFTERNOON, SEPTEMBER 26, 1912.

SANITARY ASPECTS OF HOUSING PROBLEMS.

ROBERT W. DE FOREST, President National Housing Association and former Tenement House Commissioner of the city of New York.

I have been asked to speak on the sanitary aspects of housing problems; first, as to the hygienic conditions existing on account of improper dwelling construction and arrangement, and second, a constructive, remedial program for these conditions.

That improper housing conditions exist all the world over, according to *present standards* (I emphasize " present standards "), may be laid down as axiomatic. We should note, however, parenthetically, that the present standard, and the standard of past generations, and even of recent years, has been a varying one. Many housing conditions which we deem improper to-day were proper only a few years ago. Many housing conditions in cities now forbidden by law as improper conditions were prescribed by law as proper conditions not so many years ago.

I will illustrate: The New York tenement-house law of 1901 rightly compelled the removal of all so-called school sinks, a form of privy vault intended to be flushed into the sewers, and the owners of some 7,000 tenements were compelled to make this somewhat expensive change. The same kind of privy vault had been prescribed by law as a proper sanitary arrangement to take the place of other such facilities then deemed improper as recently as 1867.

Any constructive program is therefore a varying program, dependent on the development of science applied to sanitary housing and the spread of knowledge. With the advance of science and the wider spread of knowledge, it should in intelligent communities become a progressive program.

My constructive remedial program for the improvement of housing conditions lays its chief emphasis on the timeworn process of education. Knowledge of proper housing conditions creates a demand for them. The demand will create the supply. I do not ignore legislation. I shall refer to it later as a part of the program, but I put education in the first place. I know that is not a popular method at the moment. Many of my reforming friends think it slow. They would pass resolutions and enact laws, and when they have done so smile a self-satisfied smile and calmly rest in the consciousness that the whole thing is done. They forget that education, to the extent of forming public opinion, must precede laws; that is, if laws are to stay in the statute book and are to be enforced; and they forget that education without laws makes for more progress than laws without education. Laws can be repealed. Knowledge founded on fact and experience can not be repealed. It is more durable than any creed or constitution. Some of the greatest recent advances in sanitary housing have been made purely as the result of education and are not maintained by any legal regulation.

Every one of my hearers, by taking to himself thought, can illustrate this from his own experience. I will illustrate it briefly from my own. I do so because generalizations without illustrations often fail to be apprehended.

One of the greatest recent advances in sanitary housing in America is the general introduction of the bath. So far as I know there is no law in any American city requiring baths in houses of any kind. Their general introduction is the result of a demand caused by better knowledge of hygiene.

In 1900, only 12 years ago, when the present tenement-house law of the State of New York was drafted, some ardent reformers advocated a provision compelling the introduction of baths in tenement houses. The proposition was met with ridicule. It was popular belief, at the time, that in the rare cases in which baths had been installed in tenements they were only used as coal bins. The framers of the law recognized the desirability of baths in tenements, but wisely made no requirement on the subject. Whether baths should or should not be placed in tenements to be built under the new law depended entirely on the wish and self-interest of the owners.

For the 10 years during which this law has been in operation, from 1902 to 1911, inclusive, plans have been filed in New York City for 28,037 tenement houses, at an estimated cost of $767,740,645, containing 346,244 apartments, accommodating, on an average of 5 persons to each apartment, 1,631,220 persons. Of these, 87.7 per cent have a bath in each apartment; 4.2 per cent have baths in the houses, though not in each separate apartment, and only 8.10 per cent have no bath at all. Thus, simply as a matter of education, and simply as a matter of desire on the part of tenants for baths, and on the part of owners to give them baths as a matter of self-interest—because thereby a larger rent could be obtained—has this marvelous advance in sanitary-housing conditions been accomplished.

I will use another instance of the educational process: I have just returned from a somewhat extensive automobile trip on the Continent of Europe, and have stopped at many hotels in France, Germany, Holland, and Belgium, in the smaller and in the larger towns.

I have been at no hotel, however small, where the toilet arrangements were not fairly sanitary, and I have been at no hotel, even in the smallest provincial town, in which toilet paper was not furnished. Some 40 years ago, when I was a student in a German university, I took substantially the same trip, though not in an automobile. I rarely found sanitary toilet arrangements in any small hotel. I never saw toilet paper, nor was I able to purchase any in Europe. I had brought some with me from America, and I remember showing it to my fellow traveler—a substantial English manufacturer, who looked at it with surprise, and, as I remember, with disfavor. He told me that he always acted on Lord Chesterfield's advice to his son, which was to buy cheap books so that they might serve a double purpose, and that when he was not in a position to follow Lord Chesterfield's advice, he found the London Times good enough for him, or, if he could not get it, was content to substitute the Koelnische, Zeitung, or the Figaro.

There is no law, so far as I know, requiring toilet paper anywhere. This part of a constructive, hygienic program has been carried out solely by the prosaic process of education; education in which, I note, our friend Baedeker has taken part, for, in his later editions, I read:

> Hotel keepers, who wish to commend their houses to British and American travelers, are reminded that * * * great care should be taken to insure that sanitary arrangements are in proper order * * * including * * * proper toilet paper, and no house that is deficient in this respect can rank as first class, or receive a star of commendation, whatever may be its excellence in other departments.

I venture to say that the educational process of Baedecker has been more effective than any number of ordinances in any number of European towns.

Therefore the first article of my constructive, remedial program is the dull, prosaic, slow process of education. There is no brilliancy about it. It does not appeal to the imagination like the electric signs in Upper Broadway. It is "dead slow," but it is sure.

Many of you will recall the little marble tablets that strike the eye along the shady walks of the famous German watering place at Carlsbad. I know that Carlsbad is not in Germany, but it is always popularly classed as German. "Hat geholfen" greets the eye on every side. Education has always been a potent factor in the progress of sanitary reform, and because in the past it "hat geholfen," we may be confident that it "wird helfen" in the future.

The second article in my constructive, remedial program is wise legislation, using the word in its broadest significance to include both law and ordinance. It must follow the educational process, because, unless regulation be supported by public opinion, it can not be enforced.

But proper housing conditions can not be secured without it, because, however general the education, there will be some who can not or will not be educated, and who must not be permitted to make their ignorance or their willfulness a source of contagion to their neighbors.

The basis of such regulation should not be paternalism; that is, the enforcing of the will of a supposedly wise father or despot, because it is his will, but the familiar maxim of our common law: "Sic utere tuo ut alienum non laedas." Liberty in building there should be, but only the kind of liberty defined by the fourth article of what I may call the French declaration of rights: "La liberte consiste a faire tout ce que ne nuit pas a l'autrui."

Building regulation, to which all European nations are accustomed is a late arrival in America. It has seemed to many, in its development, an infringement of inherent property rights. On the contrary, it is, when wisely framed, an essential protection to property rights. Only through building regulation can be secured the true liberty which is defined by the common-law maxim and French definition just quoted. Liberty unrestrained by consideration for others is license, not liberty.

My constructive program in regulation is more regulation; enforcement on the ignorant or careless minority by law of those hygienic principles in dwelling construction and arrangement which the educated and thoughtful majority adopt voluntarily and which, unless universally adopted, threaten the health and the life of the community.

The recent progress of regulation in the United States is notable and encouraging. I shall speak of that with which I am most familiar, namely, progress in regulating the construction and arrangement of dwellings, and particularly the class of multiple dwellings known as tenement houses. And please bear in mind that I use the word "tenement" in this paper in its legal sense, as applying to all multiple dwellings built for the accommodation of three or more families.

The earliest tenement-house law in the United States was enacted in 1867 for the city of New York. The present New York tenement-house law, in connection with which there was created the tenement-house department of the city of New York, dates from 1901. At that time there was no other State legislation on the subject. Nor was there any marked movement for tenement reforms by regulation in the country outside of New York. Since the enactment of that law, tenement-house laws have been enacted in the following States: New Jersey, California, Massachusetts, and Pennsylvania; and ordinances have been adopted in many American cities. Public interest in this subject has been rapidly increasing. The National Housing Association, of which I have the honor of being president, was organized a little more than two years ago to promote this interest. It grew naturally out of the work of the tenement-house committee of the Charity Organization Society, which included most members of the State commission, which had drafted the New York law of 1901. Since its organization, the number of cities in which there is definite interest in this subject has increased from less than 10 to more than 100. Many of these cities have housing commissions to promote proper regulation. Some of these commissions have originated from State or municipal action. more from some voluntary citizens' association, such as a chamber of commerce, a charity organization society, or a civic league.

At the moment new housing codes have been drafted and await legislative action in Cleveland, Detroit, Duluth, Kansas City, and elsewhere. The movement has steadily broadened until it now includes not only the Eastern States, where it originated, but the Middle West, the South, the Pacific coast, and Canada.

The New York legislation has thus far extended only to cities of the first class, or New York and Buffalo. In other States it has also included the lesser cities of the second class. There is crying need that such legislation should be extended to all growing cities. The evils of insanitary housing, which became so flagrant in New York as to force action as long ago as 1867, continue to exist in large part in all tenement houses built prior to 1901, when the present law was enacted, and they can not be entirely eradicated by the alterations that that law compelled.

Guarding the future in time by proper regulation before tenements are built is the only effective means of prevention. Alteration afterwards is at best a makeshift and involves hardship to property owners.

The results already accomplished by a constructive, remedial program based on education and proper regulation are so noteworthy as to encourage the extension of that program to every American city and town.

I wish to illustrate again, this time by the decrease in the death rate of my own city. Others may be able to give illustrations even more effective. I doubt not that many of our European friends can tell us of progress in Europe beyond any point that we Americans have dreamed of. I intend to compare the death rate in New York in 1900, before the new tenement law went into operation, and its death rate last year, when that law had been in operation for something more than 10 years.

Before giving these figures let me disclaim any intention of attributing this change, except in part, to the new tenement law. Since

1900 great progress affecting the health of the community has been made in New York in many directions. We have had during that entire time an exceedingly able and efficient department of health, of which Dr. E. J. Lederle is now the head, and which has had continuously the most valuable services of Dr. Herman M. Biggs, who addressed you a day or two ago. We have also had marked progress in medical and surgical science, in the nursing of the sick, and in hospital service. We have not had clean streets, but we have had cleaner streets. But we have also had, as one efficient cause of the change, our new tenement law, under which sanitary tenements have been constructed, which supply accommodation for more than a million and a half of our people, and which has effected important changes in the old tenements, notably the removal of the "school sink." All these causes have cooperated to produce the change. All can claim some share in the result. That improved housing conditions have been one important factor in producing this result can not be denied.

Returning to cold, but none the less truth-telling, statistics, the figures are as follows:

The death rate in New York in the year 1900, before these new causes began to operate, was 20.057 in the thousand. This has gradually decreased until the death rate for the first 10 months of 1911 was 15.034. Translating this into human lives, based on a population of 5,000,000, this means an annual saving of not much less than 25,000. Translating it into immunity from sickness is a task beyond my power, but which can doubtless be performed by many of you who are present.

Therefore my constructive program to remedy improper housing construction and maintenance is to continue present lines of effort—education based on the progress of science, legal regulation, made possible by general knowledge of that progress—and to protect the willing and educated many against the ignorance, selfishness, and (it may be) greed of their less enlightened fellows.

SUR LES HABITATIONS À BON MARCHÉ ET LA TUBERCULOSE.

M. Georges Risler, membre du Conseil de la Société de Médecine Publique et de Génie Sanitaire, Président de l'Union des Sociétés de Crédit Immobilier de France et d'Algérie.

"Le soleil luit pour tout le monde," dit un proverbe.

Est-il rien de moins exact?

Luit-il pour ces malheureuses familles qui, en nombre si considérable, habitent, dans nos grandes villes, des logements exigus, sombres et malsains?

Luit-il pour ces enfants qu vivent dans des quartiers où pas un parc, pas un jardin, pas un square ne sont à leur portée, leur per-

mettant d'y aller prendre chaque jour le bain de soleil et d'air pur régénérateur, et qui n'ont, pour tout terrain de jeu, que la rue et le ruisseau?

Luit-il pour ces malheureux atteints de tuberculoses osseuses justifiables de la cure de soleil et qui, à défaut de cliniques organisées en vue de ce traitement, consument leurs dernières forces dans une chambre malsaine de quelque taudis ou sur un lit d'hôpital?

Le développement de la tuberculose, et de ses ravages dans nos villes, est une conséquence forcée de cet état de choses.

Dès le dix-huitième siècle Jean-Jacques Rousseau écrivait: "Les hommes ne sont point faits pour être entassés en fourmilières, mais épars sur la terre qu'ils doivent cultiver. Plus ils s'assemblent, plus ils se corrompent. Les infirmités du corps, ainsi que les vices de l'âme, sont l'infaillible effet de ce concours trop nombreux. L'homme est, de tous les animaux, celui qui peut le moins vivre en troupeau. Des hommes, entassés comme des moutons, périraient en peu de temps. L'haleine de l'homme est mortelle á ses semblables; cela n'est pas moins vrai au propre qu'au figuré. Les villes sont le gouffre de l'espèce humaine. Au bout de quelques générations, les races périssent ou dégénèrent; il faut les renouveler et c'est toujours la campagne qui fournit à ce renouvellement."

Si ce que Rousseau écrivait à cette époque était déjà vrai, que penser de l'état actuel, avec le développement qu'ont prises nos villes tentaculaires modernes?

Aussi, partout où des régles d'hygiène sévères n'ont point été imposées à la croissance des villes, la tuberculose s'est rapidement développée, et celles-ci sont devenues de véritables mangeuses d'hommes.

Laissant de côté les graves inconvénients engendrés au point de vue moral par le surpeuplement des taudis, nous nous bornerons à citer quelques-uns des chiffres désolants (en ce qui touche à la santé publique) que nous apportent les statistiques.

A Londres, la tuberculose qui a beaucoup diminué dans le cours de ces quarante dernières années, reste cependant deux fois plus fréquente dans les quartiers où les logements surpeuplés sont nombreux, que dans ceux où ils sont rares.

A Paris, le taux de la mortalité augmente dans une proportion presque mathématique en fonction de la densité de la population et de l'encombrement de chaque logement.

Le casier sanitaire de la ville de Paris, dressé par M. Juillerat, démontre que, sur les 80,000 maisons environ que contient la capitale, la mortalité pour la tuberculose s'élvè dans 820 maisons seulement à près de 20 pour mille, presque le quadruple de la mortalité moyenne.

Le Dr. Bertillon, directeur de la statistique de la ville de Paris, écrivait aussi: "Il existe à Paris des foyers tuberculeux intenses qui rayonnent autour d'eux, et qui sont constitués par la maison elle-même. La tuberculose revient sans cesse dans ces maisons funèbres, et elle y existe à peu près à demeure. On doit chercher dans la maison elle-même, la cause ou les causes de la persistance de la maladie. Ces causes ne sont pas extérieures; elles résident dans l'immeuble lui-même."

En face de semblables constatations, les mêmes dans tous les pays, il était naturel de chercher à lutter contre la tuberculose par la suppression des logements notoirement insalubres, et par l'amélioration des autres.

Il est naturel que le Congrès de Washington se soit préoccupé de mettre en lumière les résultats obtenus dans cette lutte, et qu'il ait désiré produire des statistiques qui puissent les faire mesurer d'un coup d'œil par les hygiénistes qui se réuniront cet été dans la capitale des Etats-Unis. Malheureusement, l'œuvre qui consiste à offrir, dans une grande ville où les terrains sont chers, des logements sains et à bon marché aux travailleurs, est hérissée de difficultés.

On ne peut arriver à des prix de loyer suffisamment bas qu'avec le concours d'hommes dévoués et désintéressés qui assument une tâche d'administrateur déjà très lourde, et un petit nombre d'entre eux peuvent trouver encore le temps nécessaire à l'établissement de statistiques exactes des cas de tuberculose qui peuvent se produire dans leurs immeubles.

Nos grandes fondations, ou les sociétés d'habitations à bon marché les plus puissantes parmi celles que nous possédons, ont pu se livrer à ces travaux.

On peut dire, sans crainte d'être démenti, que les prévisions des philanthropes ont été, d'une manière générale, absolument confirmées, et que, partout où l'on a offert à la population ouvrière des logements sains, la tuberculose a reculé dans des proportions considérables.

Nos grandes fondations sont cependent les seules à nous apporter, sur ce point, des statistiques rigoureusement exactes.

Nous avons à Paris la fondation dite:

	Habitants.
Groupe des maisons ouvrières qui loge	2,126
La fondation Rothschild avec	1,999
Et la fondation Weil que en abrite	484
Formant un total de	4,609

C'est une population de beaucoup supérieure à celle de bon nombre de sous-préfectures, et qui constitue un champ d'expériences très intéressant.

Il eût été prématuré, au début du fonctionnement de ces œuvres, de vouloir tirer des chiffres qui nous étaient fournis, des conclusions fermes; il n'en est plus de même aujourd'hui. Le temps écoulé depuis qu'elles ont été fondées est maintenant suffisant pour que certains résultats puissent être dégagés avec un sérieux caractère de certitude.

Voyons ce que nous apportent ces statistiques, sans nous borner à les envisager au seul point de vue de la tuberculose, mais en réservant la place prépondérante à cette maladie si meurtrière.

En 1909, la mortalité avait été au groupe des maison ouvrières de 7 pour mille. En 1910, elle a été de 9.4 pour mille. Elle a été de 9 pour mille à la fondation Rothschild.

La mortalité moyene à Paris, en 1909, était de 17.4 pour mille, mais, dans les quartiers où sont bâites les maisons des fondations, elle dépasse sensiblement la moyenne. Dans le treizième arrondissement, où est située la maison Jeanne d'Arc, du groupe des maisons ouvrières, la mortalité est de 24.5 pour mille. Dans le quatorzième arrondissement où elle atteint 22.4 pour mille, se trouve l'immeuble de la rue de Belleville de la fondation Rothschild. Je resterai donc au-dessous de la réalité en disant que la mortalité dans les maisons des deux graudes fondations, est moitié moindre que dans l'ensemble de celles qui les environnent.

Il y a lieu de noter que les locataires de ces maisons, au point de vue de l'âge, du travail, des salaires, sous tous les rapports enfin, représentent la moyenne ordinaire de la population ouvrière de l'arrondissement où sont situés les immeubles.

En ce qui concerne la nature des maladies qui ont causé des décès, on a constaté 5 morts par tuberculose à la fondation Rothschild, 3 aux maisons ouvrières, ce qui donne une mortalité inférieure à 2 pour mille, chiffre égal à la mortalité moyenne de Londres, tandis que pour Paris il était encore, en 1908, de 5.1 pour mille.

Ceci prouve que les institutions sur lesquelles pèse la charge de venir en aide aux tuberculeux auraient le plus grand intérêt à employer les capitaux dont elles disposent à aider les sociétés d'habitations à bon marché.

Le rapport adressé au préfet de la Seine pour l'année 1910, par M. Juillerat, chef de bureau des services d'hygiène de la ville, établit q'un sixième des maisons de Paris fournit à lui seul près du tiers des décès par tuberculose. On y voit aussi que, dans les groupes de maisons dites "maisons à tuberculose," le mal va sans cesse s'exaspérant. Un îlot comprenant 281 maisons qui abritent 9,715 habitants, dans dequel la proportion des décès était de 1905 à 1908 de 12.97 pour mille, s'élève, en 1909, à 14.2 pour mille.

En somme, 100,000 francs confiés à une société d'habitations à bon marché, sous forme de souscription d'actions, rapporteront un quart ou tout au plus un demi pour cent de moins que s'ils étaient placés en rentes d'Etat, en obligations de chemins de fer, soit au maximum, si nous calculons sur un demi pour cent une diminution de revenu de 500 francs per an.

Cette somme de 100,000 francs permet à une société d'habitations à bon marché de construire, à Paris, une partie d'un immeuble qui contiendra 13 logements de 4 pièces pouvant abriter 60 à 65 personnes.

Dans un îlot où la mortalité par tuberculose atteint 14.2 pour mille, il devrait y avoir, sur 60 habitants, 3 ou 4 tuberculeux, puisque les statistiques indiquent environ 4 cas de tuberculose pour un décès annuel.

Les 13 logements salubres construits, grâce aux 100,000 francs prêtés, et qui lui imposeront une diminution de revenu de 500 francs par an, habités par 60 ou 65 personnes, sauveront donc de la tuberculose 3 ou 4 personnes par an qui, hospitalisées, auraient coûté à l'hospice entre 2,000 et 3,000 francs par an. Donc, d'un côte, perte annuelle de 500 francs de revenu; de l'autre, économie annuelle de 2,000 à 3,000 francs.

Ceci prouve que, même au point de vue financier, mieux vaut prévenir que guérir.

En 1911, la mortalité moyenne, dans les immeubles de la fondation Rothschild, a été de 6 pour mille.

Nous n'avons pas, pour cette année là, le chiffre de celle du groupe des maisons ouvrières, les statistiques n'étant pas terminées.

Par contre, nous avons aussi, pour 1911, des statistiques fort intéressantes, dressées par la Société des habitations économiques pour familles nombreuses. Elle possède 4 grands immeubles abritant une population totale de 2,605 personnes, dont 1,819 enfants, soit une moyenne de 4.8 enfants par famille.

La mortalité a été, dans ces immeubles, en 1911, de 6.6 pour mille, alors que, dans les 4 arrondissements où ils sont situés, elle est respectivement de 24.1, de 18.4, de 20.6, et de 25.8 pour mille.

Il est intéressant de noter que parmi ces 1,819 enfants on n'a relevé, pendant l'année, que 5 cas de diphtérie, 7 de rougeole, 2 de scarlatine, et 1 de fièvre typhoide. Cette accumulation d'enfants est donc sans danger, même au point de vue des épidémies, tant que les règles de l'hygiène sont observées dans les maisons.

Ce qui n'est pas moins intéressant, c'est qu'aucun décès par tuberculose ne s'est produit en 1911 parmi les 2,605 habitants des immeubles de la Société des habitations économiques pour familles nombreuses.

A la fondation Rothschild, pendant l'année 1911 il s'est produit, sur une population logée de 1,995 habitants, 2 décès par tuberculose, soit une moyenne d'un pour mille, alors que, nous le répétons tristement, la mortalité moyenne à Paris, par tuberculose, est de 5.1 pour mille.

Peut-on nier, en présence de ces chiffres qui, malheureusement, ne portent que sur un champ d'expériences limité (mais qui sont confirmés par les constatations faites au sein de toutes les sociétés d'habitations à bon marché, sans chiffres précis à l'appui) l'influence primordiale du logement sain dans la lutte contre la tuberculose?

M. Romain Rolland, dans son bel ouvrage sur Tolstoï, raconte que "pendant un hiver passé à Moscou par l'illustre écrivain, le recensement de la population auquel il obtint de prendre part, en janvier 1882, lui fût une occasion de voir de près la misère des grandes villes. L'impression produite sur lui fut effroyable: le soir du jour où il avait pris contact pour la première fois avec cette plaie cachée de la civilisation, racontant à un ami ce qu'il avait vu, il se mit à crier, pleurer, brandir le poing. 'On ne peut pas vivre ainsi,' disait-il, avec des sanglots, "cela ne peut pas être, cela ne peut pas être.'"

Tous les membres du Congrès International d'Hygiène de Washington, au millieu desquels nous regrettons tant de n'avoir pu nous rendre personnellement, répèteront ce cri, nous en sommes persuadé, et proclameront que "l'amélioration du logement ouvrier est la première des questions sociales."

RURAL HYGIENE.

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As an important if not essential preliminary to any discussion of rural hygiene, there should be presented a definite statement of the meaning of the phrase taken for the subject of such discussion.

In the present case this is the more important, since heretofore writers have considered the topic only in the light of urban experience or with reference to some well-marked need of some particular community, and they have usually reiterated those general hygienic principles which are universally applicable. There are, however, special conditions of living, special dangers to health and special needs of hygienic improvement in rural communities, and it would seem that it is only with such special problems that this paper should deal.

Strictly hygiene should deal with efficiency of living as well as with causes leading to and with methods of preventing premature death. But, statistically, any measure of human efficiency is entirely inadequate, if not altogether wanting, and this is peculiarly true if applied to the lives of those living on our farms. Measurable hygienic efforts must be directed to prolonging the life and to eliminating the contagious diseases by emphasizing those public practices and private ways of living which have been found to lead to those two measurable results. Hygiene, therefore, is the public and private observance of such practices and ways of living.

The term "rural" is somewhat lacking in precision. Popularly it is taken to represent the farming community and to apply to those

living in lonely dwellings, entirely without such communistic conveniences as, for example, waterworks or sewerage. Statistics, however, include as rural everything that is not distinctly urban, and, to make the division definite, the United States Census Bureau has ruled that all villages containing fewer than 8,000 persons are to be included with the rural part of the community. This modification of the popular notion of the meaning of the term is most important in considering measures of hygiene for these communities.

It may be worth while to show the meaning of this definition in numerical value. In New York State, in 1911, the rural community is reported by the State department of health as 2,331,668, or 24 per cent of the population of the State. Included, however, are some 80 villages, whose individual populations are between 2,000 and 8,000 persons and whose total population is 392,845. If the population of these large villages be subtracted from the rural population as above the percentage is reduced from 24 to 20. In 1900 the rural population for the same State was 2,360,033, or 32.4 per cent of the population. If, however, all villages with a poulation over 500 be excluded, the rural population was only 21 per cent. The 1910 census returns are not available in detail to the writer, but the rural population as given by the United States Census Bureau having decreased in the decade from 32.4 to 24, and the reduction being due presumably to the growth of the cities, it is probable that the true present rural population in New York State is not far from 15 per cent, instead of 24 per cent as given by the Census Bureau. The following discussion, in so far as it is based on statistical records, must necessarily deal with the larger definition of the term " rural," but it should be borne in mind that nearly one-half of this so-called rural population is actually resident in villages whose several populations are from 500 to 8,000 persons.

With this preliminary definition we may now consider our subject proper, which naturally divides itself into two parts, namely, a statistical inquiry into existing conditions in rural communities and a study of reasons and remedies for any undesirable and unhygienic way of living.

So far as length of life goes in farming communities no figures are directly available. Life tables in the United States are at best unsatisfactory on account of incomplete vital statistics, and the few tables that have been prepared do not throw any light on the relative duration of life under rural and urban conditions. The crude death rate is the only method of comparison available, and this shows two points of interest.

First, the general death rate in the country is ordinarily lower than in the city. Thus, in the United States as a whole, the rural rate is lower than the city rate by about 3½ per 1,000, as shown by the following table:

Table I.—*Number of deaths from all causes per 1,000 of population in the United States.*

	1900	1901	1902	1903	1904	1905	1906	1907	1908
Cities in registration States	18.9	17.8	17.1	17.1	17.9	17.2	17.8	18.0	16.5
Rural parts of registration States	15.2	14.6	13.4	13.8	14.4	14.3	14.1	14.5	14.0
Difference in favor of country	3.7	3.2	3.7	3.3	3.5	2.7	3.7	3.5	2.5

In New York State the difference is somewhat greater (3.75 per 1,000), indicating probably somewhat lower standards of sanitation in the cities rather than higher standards in the rural communities. The following tables gives the figures for the years 1900 to 1908 inclusive:

Table II.—*Number of deaths from all causes per 1,000 of population in New York State.*

	1900	1901	1902	1903	1904	1905	1906	1907	1908
Cities in State	19.5	18.9	17.7	17.6	19.2	17.5	18.0	18.2	16.6
Rural part of State	15.5	15.4	14.0	14.6	15.2	13.6	13.3	13.9	13.5
Difference in favor of country	4.0	3.5	3.7	3.0	4.0	3.9	4.7	4.3	3.1

In Massachusetts, where the practice of public sanitation is preeminently a matter of State supervision, the difference is much less, in some years the rural death rate being almost as high as the city rate, as shown by Table III:

Table III.—*Number of deaths from all causes per 1,000 of population in Massachusetts.*

	1900	1901	1902	1903	1904	1905	1906	1907	1908
Cities in Massachusetts	18.5	17.1	16.6	16.6	16.4	16.9	16.8	17.7	16.7
Rural part of Massachusetts	17.5	16.2	15.2	15.9	16.1	16.4	15.9	16.9	15.9
Difference in favor of country	1.0	.9	1.4	.7	.3	.5	.9	.8	.8

Therefore, in so far as the death rate is an index of the length of life and measures the health of a community, country conditions are relatively satisfactory from a hygienic standpoint, and the attention of the sanitarian should continue to be directed to improvement in cities.

But, on the other hand, city death rates are already definitely and continuously decreasing, due presumably to a better understanding of hygienic laws by the citizens and to a more general obedience to those sanitary regulations which are enacted by the municipality.

Country death rates, however, do not decrease in the same ratio. Thus in New York State not only has the urban rate fallen from 19.5 in 1900 to 15.4 in 1912, but those sections of the State, such as the vicinity of New York City and the Hudson Valley, where the urban development is most marked, the mortality decrease has been similarly pronounced. The rural rates, on the other hand, show no such decreases. This may be accounted for partly by improved registration, the latter making an actual decrease, but the difference in the rate of decrease, even with this correction, is still noticeable.

If, however, it were possible to separate the real country population from the residents of small towns or villages, the latter would be found, the writer believes, to be the most important factors in maintaining the present rural rates. Thus in New York State in 1911 the death rate reported in the rural community was 15.8 in a total population of 2,319,055. But, separating the villages whose death rates are given separately and whose populations range from 2,000 to 6,000, the death rate of these villages is found to be 16.7, and the corrected death rate for the remainder is 15.4. If the village rate was given for smaller places independently of that of the township in which they are located (as is the present practice), the village rate would undoubtedly be found to be still higher and the corrected rural rate correspondingly lower.

One other point may be made before leaving this part of the discussion. Dr. Farr, the English exponent of vital statistics, once gave it as his opinion that the difference in density of population between ordinary country communities and city districts should mean a difference in death rates of about 10 per thousand. This would be due, he believed, to the greater amount of air space in the country, to the better conditions of living, and to the reduced danger of secondary infection. As a matter of fact, while a comparison of different districts of a city may show a reduced death rate with reduced density of population, the law does not hold, apparently, for rural districts, at least in this country, to-day. If it did, then the existing advantage of rural conditions, shown by a death rate reduced by 2 or 3 per thousand over city rates, would not be a matter of congratulation, but rather a cause of reproach, in that the 2 or 3 is not the 10 of Dr. Farr.

It should also be pointed out here that any comparison of death rates that does not consider the relative number of children in the country and elsewhere may be most misleading. The Census Bureau gives no figures to show the distribution at the various age periods in the country, but limits this interesting basis for comparisons to cities with populations of over 25,000. There is not, then, any way of either building up life tables for the country by itself or for correcting the rural death rate by the percentages of population at different ages. Such studies as have been made, however, as, for example, those in Otsego and Putnam Counties (two typical rural communities of New York State) a few years ago show that, in the country, as in other parts of the State, there is a rapidly decreasing birth rate, and that this decrease has resulted in a marked excess of adults in the country as compared with the cities. Thus, in the two counties mentioned, it was found that between 1860 and 1900 the total population was stationary, changing by less than 2 per cent, but that the number of children under 5 years of age had decreased 7.5 per cent. Or, out of 63,760 people in this rural part of the State, there were nearly 5,000 fewer children in 1900 than in 1860. Further, it was found that this existing number of children was less, by 3,500, than the present average of the registration area of the United States. If this decrease in the number of those living at the lower age periods be general in rural communities—and there seems to be little doubt of it—then, because of the higher mortality of children, the country rate, for this reason alone, ought to be lower than the city rate, irrespective of the natural advantages of the country.

As a summary, then, of what has been said so far, it may be repeated that the crude general death rate in the country is less than in the city, but that, as modern sanitary regulations are more generally enacted and enforced in cities, the difference tends to disappear; that, judging by the lack of any tendency to decrease in the rural rates, the advantages of modern sanitary reform are not yet felt in rural communities; that, on account of natural physical advantages and the reduced number of young children in the country, the rural death rates should be markedly less than city rates, even with the same enforcement of identical sanitary laws.

The death rates of children, it is believed, reflect better than any other test the insanitary conditions of living, and if the country is to-day more healthful than the city and less in need of sanitary reform, the fact should be shown by lower death rates of children, particularly of those under 1 year old. That this is so hardly needs figures to substantiate the statement, and the United States Census Bureau has given no recent figures on this point. But in 1900 the infant mortality rate throughout the country was 149.4; that is, there were 149.4 deaths of infants out of 1,000 births in the same year. In Scotland for the 15 years ending 1890 the rate was 120, and in Sweden for the same period it was 97. With these figures for comparison, it may be noted that in 1900 the city rate in the United States was 165.8 and in the rural districts it was 108.7. In Massachusetts for the eight years ending 1897, the city rate was 165.3 and the rural rate 129.5. In

New York last year (1911), the city rate was 121.6 and the rural rate 87.7. This seems to indicate that the effort to reduce the rural death rate and to prolong the rural lives does not need to be directed particularly towards the infants, but that the avoidable loss of life comes later on.

In the constitutional diseases, however, the country resident seems to have no advantage over his city cousin. Thus, in New York, in 1910, the number of deaths from cancer, diabetes, pneumonia, Bright's disease, diseases of the nervous, circulatory, and digestive systems, and other general diseases, were subtantially identical in city and country—greater, indeed, in the country in the case of influenza and nervous diseases. The country excess in suicides and ill-defined diseases is also marked. The most persistent disorder that is always in excess in the country is influenza, and similar diseases of the lungs and throat. The death rate from influenza, for example, in New York State, in 1911, was 15 per 100,000 for the cities, while the country rate was exactly double that. In 1910 the two rates were 9.4 and 34.9, respectively. Exposure, lack of vitality at time of exposure, and general living conditions, must be considered responsible.

Old age undoubtedly claims more victims in the country, but, not knowing the numbers of those living at the different age periods, the meaning of such excess is uncertain. In New York State, in 1911, the city ratio for those over 60 to all deaths was 25.9 per cent, and the rural ratio was 50.5 per cent. Thus, more than one half of all the deaths in the country that year were of those over 60, a most favorable showing. But it is almost certain, in view of the studies made in New York State, that the proportion of elderly adults is much greater in the country, because the young people leave the villages and farms for the attractions of the city.

One point may be added. For some time it has been the practice of writers on typhoid fever to dwell on the dangers lurking in the waters of the old farm well. To polluted wells are ascribed by them outbreaks in neighboring cities, and "summer typhoid" and "vacation typhoid" are made a reflection upon the quality of the rural water supply. There is not time here to attempt a complete defense of the farm well, but the following table from the United States Census Bureau suggests that the country has perhaps been maligned:

TABLE IV.—*Number of deaths from typhoid fever per 100,000 of population in the United States.*

	1900	1901	1902	1903	1904	1905	1906	1907	1908
Cities in registration States	28.5	26.5	25.9	24.6	24.0	22.0	34.2	31.7	24.5
Rural part of registration States	34.6	28.8	27.0	24.7	23.7	23.0	28.6	26.0	24.3
Difference	−6.1	−2.3	−1.1	−.1	+.3	−1.0	+5.6	+5.7	+.2

The same thing is shown by figures from New York:

TABLE V.—*Number of deaths from typhoid fever per 100,000 population in New York State.*

	1900	1901	1902	1903	1904	1905	1906	1907	1908
Cities in New York	......	38.9	33.9	43.0	40.3	32.2	30.5	32.1	32.4
Rural part of New York	......	20.3	24.1	23.2	21.3	22.3	21.3	19.9	20.8
Difference	......	18.6	9.8	19.8	19.0	9.9	9.2	12.2	11.6

When it is remembered that among the rural population are included the large villages where congestion has already made its impression, where a public water supply is installed, but where cesspools and wells still elbow each other in the back yards, it will be seen that the real country has scarcely all the evils attributed to it. Certainly, so far as typhoid fever is concerned, the attention of sanitary reformers needs to be directed to the water supply of the village and small city rather than to the farm well.

What is, then, the reason for the maintenance of the rural mortality rates at figures which, while low when compared with city rates, are high, in view of the natural sanitary advantages existant in the country? The answer seems to be unmistakable, and is that disease and death to the countryman come from violations of the laws of personal hygiene, from wrong living in its varied forms, and that improvement must come by teaching and persuading him to obey more truly the laws of right living. The particular violations will obviously differ in different parts of the country. Thus, in the South, where typhoid and the hookworm are prevalent, special attention needs to be given to the construction and use of a sanitary privy, so that the ground and the ground water may not be made vehicles for the transmission of those diseases. In northern countries there is the subject of pure fresh air to be impressed, so that the toll of lives forfeited by living the winter through in small unventilated rooms may be reduced. The advantage of a reasonable, varied, and moderate dietary needs also to be pointed out everywhere, so that the deaths from ailments in the digestive system can be eliminated.

The question and the discussion are not unimportant. So long as the population of our cities is largely recruited from the country, and so long as the vigor and energy of our people are found in country-bred men, so long must the health and efficiency of the rural communities be a vital matter to this Republic. As was tersely said by one of England's greatest prime ministers:

> You can take the richest and most beautiful of kingdoms; cover it with temples and palaces; defend it with armies and navies of the most advanced type; do all things else to forward its interests and its glory, and, despite all those things, if its people decline in stature and vigor, or its birth rate falls below its mortuary rate, that nation is doomed.

RURAL HYGIENE.

Dr. JOHN N. HURTY, Secretary of the State Board of Health of Indiana, Indianapolis.

I take it that the term "rural hygiene" simply means the practical application of hygienic knowledge to the farm and to the rural districts, to the end that life may be bettered.

The rural dweller is of the genus homo, the same as the city dweller. "If you prick him, he will bleed; if you tickle him, he will laugh; and if you poison him, he will die."

The questions to be answered in regard to rural hygiene are: What principles and methods of general hygiene are required or are applicable? How may they be practically applied?

The rural dweller, as well as the urbanite, should be well born, for this is the first and the great hygienic commandment.

Let us review the 10 classes, whose defective inheritance will most probably be transmitted, which may be relieved to a slight degree by ameliorative hygiene, but whose members will all their days threaten others with disease, will require much medical treatment, and will be burdens to themselves and to society, and who, if they do not meet early death, are so much the worse off. These are found on the farms as well as in the city. The higher, the perfect hygiene, either rural or urban, in true charity and love, would prevent the birth of (1) the feeble-minded class; (2) the pauper class; (3) the inebriate class; (4) the criminal class; (5) the epileptic class; (6) the insane class; (7) the constitutionally weak, or the asthenic class; (8) those predisposed to specific disease, or the diathetic class; (9) the deformed class; (10) those with defective sense organs, as the blind and the deaf, or the kakaesthetic class. Of course only those who are by inheritance members of these classes, should be prevented by forbidding the mingling of defective spermatozoa and ova.

Let this first step of love and wisdom be taken by hygiene; then what should be, in the line of better health and strength and deportment, will certainly appear. But, alas, our present institutions, our laws, sentiments, religions, all incidents of our present stage of evolutionary development, will not permit the laying of the ax at the root of the evil, and, being thus restrained, hygiene must for the present be content to lop off the branches, which will immediately grow again at a pace which will keep even with, if it does not surpass, the lopping.

In offering hygiene to the farmer, the hygienist believes his services are needed, and he further believes it to be his duty to give them. But let him not forget that unless his work is well foundationed it will not stand. Health and strength can be developed only in normal tissues. Even supreme effort will not entirely prevent the invasion of infections. I insist, therefore, that it is not sufficient to simply teach the laws of well-being, and how, through obedience to them, health and a virile long life may be attained, but hygiene must force hygienic practices upon the people, the same as was found necessary in regard to education, which we have made compulsory. Yet even compulsory house and personal sanitation is not enough; and so I return to the first proposition, which is: All must be as well born as possible. Through breeding let us eliminate the constitutionally weak and those predisposed to disease.

VITAL STATISTICS.

To advance rural hygiene, accurate vital statistics must be secured. To act intelligently we must know the facts concerning diseases, births, and deaths in rural life, and also the general health conditions. We must know the preventable diseases which particularly affect the rural regions; we must know their extent, we must know their mortality and relations to age and sex. In a word, we must have these matters reduced to a mathematical basis. The question is not, how many manure piles are there, or how is sewage disposed of? For there should be no manure piles, and sewage should always be disposed of in a sanitary way. The presence of insanitary conditions can quickly be determined, and this is a separate work for each individual household. But the vital statistics! They would give an understanding of the entire rural situation, they would show where the weak places are, they would give us the vital latitude and longitude of the rural dwellers, they would give a specific basis for practical action! Any system of rural hygiene which is not preceded by the collection of accurate statistics and their careful analysis, will be insufficiently founded and incomplete. In this work the attention and cooperation of the farmer must be secured.

EDUCATION IN HYGIENE.

Education of rural dwellers in hygiene is absolutely necessary. Before effective and lasting work can be done the individual who is to be benefited must learn that sickness and disease are not afflictions. That they are brought upon him through defiance of the laws of his well-being. He must be taught that typhoid fever exists because all human sewage is not disposed all of the time by all of the people in a sanitary way. He must fully appreciate that typhoid fever, like sin, is a reproach to any community. And when the farmer is called upon for money to send the gospel to India let him be told that the plague death rate in that heathen land is less than the rural typhoid rate in the United States. This knowledge may lead him to use the

India missionary money to construct a sanitary privy, and thus carry the gospel of hygiene and health to his own house.

But no one will deny the value of and necessity for education in hygiene. I simply call attention to the matter.

THE FARMHOUSE.

Many farmhouses are insanitary. In such the farmers and their families experience not a little sickness, and frequently early death. The natural duration of life, as in the city, is only about one-half realized on the farm. Very many farmhouses are built flat upon the ground. Such are damp, and mold grows upon the shoes in the closets, and also upon the bread in the pantry. Ground air, loaded with carbon dioxid and odors and effluvia from the decay of organic matters in the earth are always present in houses flat upon the ground. This is especially true after rain, which falling upon the ground surrounding the houses, afterwards soaks in, and, displacing the ground air, forces it upward into the dwelling. Farmhouse bedrooms are too frequently very small, with low ceilings, and rarely more than one small window. In these cubby-holes two, three, and even four persons sometimes sleep. The one little window is rarely raised for ventilation, and if it were wholly kicked out even then enough air would not be admitted to properly oxygenate two, not to consider four persons.

Concerning the question of ventilation, it must be noted that frequently, so soon as cold weather comes, the farmer closes his house, lights the fire in his air-tight stove, and from this time on through the winter until spring, the only fresh air likely to be admitted finds entrance through cracks or enters when the outside doors are opened to admit some one. In many instances I have entered farmers' houses, where all cracks and even keyholes were stuffed with rags, and the inmates all had "colds," and where one or as many as two had tuberculosis, the entire assembly coughing and spitting promiscuously. Sometimes the oral evacuations were received in boxes containing sawdust, and these not emptied until spring, or they were received upon newspapers spread on the floor at the side of the spitter's chair, or they spat in the wood box or coal scuttle, or occasionally the stove door was opened and the stove used as the spittoon. In such rooms, and they are not occasional, the air is always fetid, the people dull, languid, stupid, and even the fire burns feebly for lack of oxygen. It is no wonder that tuberculosis is a constant dweller, not a visitor only, in rural communities, and many respiratory maladies the farmer has always with him.

The disposal of household wastes at the average farmhouse is insanitary. Kitchen slops are poured upon the ground just outside of the kitchen door or, as I have seen in four instances, poured underneath the floor through an opening made by raising a loose board.

Again, a leaky tub or bucket holds the kitchen garbage, until the farmer, his sons, or the hired man in such a home "can stop eating tobacco and talking politics long enough to carry the stuff to the hogs."

All too frequently one dilapidated open-to-flies privy serves the whole family. It is nosed the moment one walks around the house, and its flies have a straight and unobstructed path to the unscreened kitchen and dining room. Close to such a farmhouse is the barn or stable, with heaps of manure and flies and vermin galore. Within this barnyard cattle sometimes stand knee-deep in ooze composed of manure, earth, water, and urine; hogs wallow in it, and poultry and men wade through it.

There are sometimes two wells, one at the house and one at the barn. Not infrequently both are polluted, and are the constant source of illness, if not of disease. It is astonishing and discouraging to note the frequency of the intimate relations of the farm well and the farm privy. It seems that if the contour of the land will permit the average farmer is sure to locate his privy so that the vault fluid will drain into the well. The daily ingestion of water containing even minute amounts of fecal and urine extracts, though pathogenic germs are absent, causes indigestion, nausea, and symptoms remindful of auto-intoxication.

If ever I am compelled through thirst to drink water from a dug well I do it with nose and eyes closed and in fear and trembling.

Cooking.—Whether or not average urbanites know how to cook well I will not here discuss, for the city is not now in question; but I must say that, in my experience, good cooking is not an art which is generally known and practiced on the farm. Jams, jellies, preserves, and fruit butters are in full flower on the farm, and also fried chicken; but the bread, the overfried meats, the grease-engulfed vegetables, and tough enemic pastries, from them, wherever they may be, good Lord deliver us.

Farm bread, in my experience, is all too frequently an unfit food. Too many times it is overfermented and underbaked; its texture is poor, and it contains live yeast cells which the underbaking has permitted to live. The live yeast cells grow in the stomach when slow digestion exists, causing sour stomach, indigestion, and plenty of gas. The uncooked starch can not be digested, the puttylike interior, not being susceptible of mastication, falls in a leaden mass into the stomach; and so it is that farmhouse bread too frequently is a "sinker," indeed, causing dyspepsia and malnutrition.

Bathing.—Bath tubs in farmhouses are as rare as honesty among trusts. The ordinary or low-grade farmer stinks, not only in the field and the haymow (that is certainly excusable), but in the parlor, in the suburban trolley car, and in the church. To be sure, like the urbanites, enough of them bathe to save the craft from damnation. One righteous man in a thousand would have saved Sodom. In one instance with which I am acquainted a farmer worth $100,000 (this, you know, proves he was practical), came into possession of a sanitary house which was provided with two inside flush closets and a bathroom, the waste disposal for which was all right. He tore out the closets and bath, saying "he could not stand for such awful things in his house." I move that he be elected to Congress to vote with the patent-medicine league and other fakirs against all measures intended to improve and protect the public health.

We hear of the "fine country dinners," and of the farmer's table groaning with good things. Truly, the jams, and the jellies, and the fried chicken are good, and that frequently is the trouble; they are too good. From two to four kinds of pickles may be present, and they stimulate the appetite, cause overeating, and bring dyspepsia.

The dyspepsia on the farm, the autointoxication with its concomitant rheumatism, bad complexion, headaches, biliousness, so-called malaria, vertigo, and eczema are frequently easily traceable to a table groaning with good things to eat.

The frying pan is all too much overworked. Foods cooked hard, and hog grease, are too abundant for good health. Too much smoked, pickled, and salted meat is eaten, and vinegar and pickles are abused. On the farm, of all places, the plain, bland, unstimulating nutritous foods, which strengthen the body and so rejoice the intestinal tube, should be used. Failure to do so surely brings its train of ills, and then the patent medicine, with its 12 to 20 per cent of alcohol is appealed to, and, of course, the last state is worst than the first. I believe it is the bad air, the polluted drinking water, the neglect of the bath, the poor bread, the fried, embalmed meats, and rapid overeating which cause the farmer to buy so largely of patent medicines. He knows he is hit, he feels the hurt, and, not knowing his ills are self-inflicted, and not knowing how to remedy them by obeying the laws of his well-being, he flies to alcohol and other drugs in the form of patent medicines. It would be difficult to find a farmer's house which does not harbor patent medicines. If you go into his cellar, the empty patent-medicines bottles are likely to be heaped in the corners; if you go into his bedroom, they are there; in the kitchen, they are on the shelves and in the cupboard; the ash pile is topped with them; they stand on the beams in the barn, and, if you go into the woodshed and the smokehouse, lo! they are there. The farmer, if he is to be strengthened and his duration of life increased, must be raised out of the patent-medicine stage of ignorance.

The neglect of oral hygiene is another cause of ill health on the farm. It will astonish anyone to inspect the mouths of rural school children. I believe it is safe to say that 95 per cent of them have unhygienic mouths. Malformed mouths, made so by thumb sucking and other bad habits which ignorance permitted, are not infrequent. Seven-year molars are permitted to decay and be lost, and this means deformity of the mouth and a handicap in life.

The extent of dental decay among rural children, and the physical and mental retardation due to it, if expressed in horsepower wasted would show a loss sufficient to run a fair proportion of farm machinery.

The large number of short graves in rural graveyards do not speak loudly of the intelligent application of hygiene.

SUMMARY.

It is certain that sickness and disease exists unduly on the farm, and that the duration of life is at least 30, perhaps 50, per cent short of what it should be.

The farmer, in the presence of limitless oceans of air, which can not be cornered by the trusts nor taxed either for protection or revenue, shuts it out of his home, and, in consequence, suffers from air starvation as is expressed in coughs, colds, la grippe, pneumonia, consumption, and other respiratory maladies.

The farmer, supplied with an abundance of healthful foods, all too frequently prepares them poorly, gives them minimum mastication with diseased teeth in an unclean oral cavity, and then suffers from the ills which attend assaults upon the digestive tract.

The farmer too frequently neglects to dispose of all his household and bodily wastes all of the time in a sanitary way, and so suffers from typhoid fever to such a degree that this malady is known as a rural disease.

Only a small percentage of rural schoolhouses are sanitary. They are sometimes unsupplied with pure drinking water, an essential to secure healthy child growth. They are unsupplied with ventilating ducts, are sometimes wrongly and insufficiently lighted, rarely warmed evenly, seats unadjustable, cloakrooms unventilated and unwarmed, and are surrounded by mud, and in all ways unattractive and forbidding.

The privies are very likely to be crude, noisome, and a disgrace, fostering disease and immorality. Oral hygiene is universally neglected, and rotten teeth and pus cavities bring indigestion, pain, ill health, disease, and inefficiency to the school children.

The farmer, to relieve the sickness, pain, and disease which he brings upon himself through violation of the laws of his well-being, rushes to patent medicines. The alcohol they contain gives temporary relief and not infrequently engenders the alcohol habit. Other drug habits are contracted through the taking of patent medicines.

Verily, before the rural dweller, and the city dweller too, can live normally, they must be raised out of the patent-medicine stage of ignorance.

THE PROBLEM OF DRUNKENNESS.

Dr. IRWIN H. NEFF, Foxborough State Hospital (for Inebriates) Foxborough, Mass.

INTRODUCTION.

The paper which I submit for your consideration is an attempt to present as briefly as possible the modern view of inebriety and to suggest a workable plan for taking care of these perplexing cases, so frequently seen in all walks of life. Lack of uniformity of opinion has heretofore interfered with the adoption of any practical curative or custodial scheme for taking care of cases of drunkenness. We have gradually come to the opinion that something should be done for the confirmed and immoderate drinker, and popular opinion now demands that concerted effort should be made to inaugurate some plan which will be feasible and practical; one which will not only help the victim of drunkenness, but will lessen the enormous expense annually incurred in caring for these people who succumb to their weakness for artificial stimulation.

Believing, as I do, that all inebriates should be removed, at least temporarily, from their customary environment, I have purposely omitted all reference to noninstitutional treatment, which I believe should supplement institutional care, and should be considered as a part of the out-patient medical service of an institution designed for the care of inebriates. It is also my belief that the ultimate solution of the problem of drunkenness is intimately associated with the study of the personality of the inebriate. An institution designed for such a study, scientifically and humanely conducted, should be considered as an educational center offering opportunities for the study of drunkenness from all viewpoints.

PREAMBLE.

The inefficiency of the present system of caring for cases of drunkenness has created a popular demand for a better and more discriminating method of handling (1) those cases of drunkenness which are constantly appearing in our courts, and (2) the cases of alcoholism which voluntarily subject themselves to treatment.

The futility of punitive measures, in caring for cases of drunkenness, is universally conceded. The large percentage of relapses of those sentenced to our jails and houses of correction is a convincing argument for a more rational and humane method of handling such cases. The present way of taking care of arrested cases of drunkenness by release, fine, suspended sentence, probation, and determinate and indeterminate sentences is acknowledged to be unsatisfactory, but as no adequate substitute for such procedure has been offered, the method has been continued with recognized disadvantages. Such a system is manifestly unfair to the taxpayer, who pays for the imprisonment of the offender, and unfair to the victim, who is not given the care or treatment which his condition warrants.

The growth of the present interest in the alcoholic can be said to have originated from three sources: The sociologist has for a long period of time realized the necessity for the rational handling of drunkenness, which, as he knows, is closely related to poverty, domestic infelicity, crime, and mental and physical decadence. The medical profession has awakened to a realization of the fact that the problem of drunkenness is primarily a medical problem and properly belongs to a branch of medico-social work which has heretofore been neglected. Lastly, the judiciary have shown their willingness to affiliate and cooperate if some practical way of handling court cases be devised.

The interest in this subject is perhaps better and more convincingly shown by the attitude of many States which are considering legislation, or which have legislation pending, which will permit them to give State care and treatment to the inebriate.

It is the consensus of opinion that any plan put into execution for the control or treatment of drunkenness should be directed by States or municipalities. For obvious reasons State control is preferable and should be strongly advocated. By assuring State control, we are reasonably sure of securing modern methods which will be legitimate, and which will carry out economical and humane measures for the proper care and treatment of these people.

The ignorance of the public of the true nature of drunkenness, of the causes for the condition, and the procrastination of those who are in power to direct reform movements, have proven serious handicaps to the carrying out of any practical plan. Such ignorance or heedlessness has also been responsible in great part for the many irregular methods which have been advanced and heralded as cures for drunkenness and allied conditions.

Any method designed for the care and treatment of confirmed drunkenness, to be practical and wide reaching, must recognize certain fundamental starting points which can be enumerated as follows:

1. A comparatively small percentage of users of alcohol are confirmed drunkards or inebriates.

2. The appropriate care of the alcoholic implies both curative treatment and custodial care; the curative treatment should be directed to the case which is likely to be benefited; the custodial, for economic reasons, should be directed to the recidivist, constantly appearing in the courts. Such a differentiation must eventually be made, and appropriate segregation of these two types established.

An attempt to successfully use a remedy for a condition, or to establish a cure for a disease has, as an essential requisite, the implication that the nature of the condition or the disease is understood. Before modern methods of medical investigation and diagnosis were put into practice, sporadic attempts were made to treat many diseases, although the true nature and pathology of such ailments were unrecognized. These haphazard methods of treatment were unsatisfactory, and quickly became obsolete when the true facts concerning the diseases were ascertainable. A parallelism is found in drunkenness. We can not establish a uniform and satisfactory method of treating the grades of chronic alcoholism until we have a common knowledge of its causes, nature, and particularly of the susceptibility of the distinctive types to treatment. We must expect a wide divergence of opinion until such knowledge is obtained, disseminated, and generally credited. I refer specifically to chronic alcoholism, or confirmed drunkenness, disregarding acute alcoholic intoxication, which, from a medical standpoint, is quite clearly understood. Drunkenness, as we are now considering it, implies repeated attacks of intoxication due to the ingestion of poisonous quantities of alcohol. For the purposes of this paper this definition is acceptable.

There are two widely opposite opinions of drunkenness:

The more modern conception of the condition, denoting it a disease, has too often been accepted without proper qualifications. Opposed to this opinion there are those who declare that drunkenness is a habit, and that the drunkard purposely invites drunkenness, a condition which he could prevent if he so desired. The believers in the theory that drunkenness is a disease declare the alcoholic irresponsible, and demand that he be segregated, and be compelled to submit to enforced detention and compulsory abstinence. The adherents to what I may call the habit theory, who believe the victim of drunkenness to be a slave to his habit, suggest punishment in some form for the offender against society.

The acceptance of either one of these theories of drunkenness implies one remedy—coercion; in other words, a suggestion for the enforcement of punitive measures. Often the method of punishment meted out to these individuals shows considerable originality and variability and a noticeable lack of uniformity. It is not denied that in some cases such a method has been efficacious, but it is questioned whether a true case of inebriety has ever been materially or permanently helped by such a practice. The futility of such a method has long been recognized, but as no satisfactory substitute has been offered this time-honored custom has prevailed. From the sociological point of view many of the problems of drunkenness have been thoroughly studied. The sociologists engaged in the study of drunkenness have seemed to appreciate the magnitude of the task, and have gradually accumulated certain facts which have furnished them with admirable working capital. My association with these people and with court officials has shown that they are anxiously awaiting more light on the medical aspects of the subject. They keenly appreciate that without the aid of the medical profession drunkenness must remain an unsolved problem. It is only within the past decade that the physician has recognized that the study of the inebriate is a medico-social study, and that the problem of drunkenness is primarily a medical problem which has heretofore received insufficient attention.

The problem of contriving a practical plan for the prevention and cure of inebriety rightly belongs to medicine, as its correct solution is, first of all, a remedial measure, and, secondly, an educational, along the lines of preventive medicine.

The study of inebriety begins with the inebriate, and requires individualization in treatment in its strictest sense. It is only by intricate analyses of the individual cases that we can appreciate the true personality of the inebriate, and thus can correlate the data which will give us a working basis and a rational method of caring for these people who drink to their detriment and destruction.

R. W. Branthwaite has made the statement that every alcohol user may be placed in one of three classes: First, those who drink moderately; secondly, those who drink more freely than is consistent with strict moderation, or who are occasionally intoxicated; thirdly, those who are habitually intoxicated, or are subject to occasional outbursts of uncontrollable drunkenness.

The same author believes that the pathologic inebriate is represented approximately as somewhere between 2 and 2.5 per cent of all alcohol users. Such an authoritative statement prepares the way for the acceptance of the author's description of the inebriate, which is as follows:

> The distinctive characteristic of the man who is an inebriate is his inability to take alcohol in moderation, despite the most strenuous effort of which he is capable. It is a psycho-neurotic fault that implies defective resisting power to the action of alcohol or drugs. It is possible that inebriety may be acquired by

long-continued indulgence, just as the tubercular disease may be acquired by long exposure to chronic infection, or a brief exposure to an exceedingly virulent infection; but it is more properly inherited as a diathesis in most cases, remaining latent or becoming evident, according to the personal habits or environment of the individual.

Observations which have been consistently made at the Massachusetts hospital for the treatment of inebriates, during the past four years, justify us in corroborating these conclusions. The result of our experience can be expressed as follows:

1. Inebriety is an expression of nervous weakness; founded on this weakness is a habit which we call drunkenness.
2. The antecedent weakness is either acquired or is in the nature of an inborn defect.
3. The nature of this nervous weakness is as yet not accurately defined, but it appears to be closely allied to degeneracy, and related to the minor functional nervous diseases.
4. The inebriate is, as it were, a sum total of his personality and the symptoms attributable to alcoholism.
5. Inebriety should be considered a disease in the sense above described. The acceptance of this theory implies responsibility on the part of the inebriate, although it admits of extenuating circumstances.
6. There is no known drug which can permanently eradicate the desire for drink.

The inebriate is a personal equation, each case a personal problem, requiring for its solution individual consideration and treatment. It should be remembered that the correct and ultimate solution of such a problem rests largely with the patient, who by his own efforts must cooperate in the educational measures carried on at the hospital. Any correctional measure imposed or any medical treatment instituted, if it is finally opposed by the patient, must necessarily end in failure. The experience of those who are concerned in the treatment of the inebriate is overwhelmingly in favor of the educational system, as it is a form of treatment which insures cooperation between the patient and the physician. The educational system, so called, which is now in vogue in the hospitals of Great Britain, Australia, Switzerland, and is exclusively in use in the State hospital in Massachusetts, recognizes that there is no known drug which can permanently eradicate the desire for alcoholic stimulants. These hospitals rely largely for treatment upon the effects of pure air, good food, abstinence from alcohol and drugs, regular hours, and out-of-door skilled labor. Medicine is given where needed, but this program, which is followed in the best prisons as well as in the hospitals, is not in itself sufficient to cure the pathologic inebriate. The chief method of cure for inebriety depends upon our ability to cause the patient to recognize his defect and by strengthening his self-control to cooperate in his own recovery.

Two years ago Massachusetts instituted a medical after-care department, in charge of a physician assisted by the hospital staff. This out-patient department was from the first considered an integral part of the hospital, and has been maintained and supported by the hospital. The physician in charge, occasionally assisted by the hospital staff, has successfully carried out its provisions. The after-care department has proved to be eminently successful, and is to be highly commended. The duties of this department have been gradually extended, and a considerable amount of out-patient work has been accomplished. This medico-social work is participated in by every member of the hospital staff, and is considered as supplementary to the educational work carried on at the hospital.

My knowledge of the countries, cities, and towns which have provided accommodations for the care of inebriates would indicate that the benefits derived from such care would have been enhanced if it had been possible to have carried out a more thorough differentiation of cases, which would have allowed for a better segregation of the types. To secure such segregation or appropriate grouping of cases and institutional care there is one system which is distinctive and which appears to be eminently practical. I refer to colonization, which offers peculiar advantages for the treatment of the inebriate. In order to establish a colony system for the purpose of caring for the inebriate it is essential that a large area of land be secured which will allow for a cottage grouping, and which will also provide sufficient farm land so that a proportionate area can be allotted to each group, with the single exception of one, a small terminal custodial group, composed of recidivists. For the purpose of carrying out the educational scheme, and for the individualization of the patients, each cottage should be considered a unit, and, if possible, this unit scheme should be carried out to the minutest detail. Necessarily, such a plan must allow for receiving wards, where the differentiation of the cases should be made before the patients are placed in the respective cottage groups, a hospital building for those physically ill or incapacitated, and service buildings, to secure concentrated business administration. With the exception of the receiving ward, the hospital building and service buildings, which constitute an administration group, all the buildings should be detached and administered as units. In this way the association of types can be reduced to a minimum. Centralization is to be avoided, as far as is practicable, as it defeats the purpose of the plan.

It should be understood that the system above described refers more particularly to the case which is susceptible to hospital measures. The case which has been repeatedly tried out and has, by reason of its chronicity and consequent moral deterioration, proved to belong to the custodial class, should be cared for in larger units and with a lessened expenditure. The size of the unit is a matter of importance. A larger unit than 15 to a cottage in the hospital group is not recommended. On the other hand, the custodial unit could be safely considered to be 25. A larger number in either group will be found to seriously interfere with the individualization of the patient, which is the keynote of our treatment. The quality or character of the unit is an important consideration; it embodies environment suitable to temperamental characteristics, and necessarily includes a consideration of the patient's social status, his former mode of living, and the results anticipated and desired from educational treatment.

The natural criticism to a colonization scheme, as above outlined, would be the considerable expense involved. This criticism can be met by asserting that such an expense will be saved many times over. It is certainly cheaper to cure an inebriate or care for him as above planned than to pay for his constantly accumulating expense from repeated sentences to jails and houses of correction. Again, it is well to remember that in a well-organized colony for inebriates the greater part of the construction and repair work can be accomplished by patient labor. Another source of revenue which would materially lower the per capita cost would be the sale of the excess farm products which would be procured largely through unpaid labor.

Massachusetts has had for 20 years an institution for the treatment of inebriety. Those in charge, realizing the greater needs of extension of treatment and the defects of the present hospital, have secured legislative action and have been granted appropriations which have allowed for the purchase of land and will allow for the erection of buildings for the care of both the hospital, or hopeful, case and the recidivist, who properly belongs in the custodial group. The most obvious needs for the proper constructive treatment of the inebriate are as follows:

1. Sufficient land for agricultural development.
2. Sufficient accommodations for industrial training and workshops.
3. An opportunity for segregation of the diverse types.
4. An opportunity for the treatment of both sexes.

Remembering these needs, land was purchased during the year 1911. The tract comprises approximately 1,000 acres of both cleared and wooded land. The site is made up of hills and lowlands, allowing for natural building sites, and affords sites for farms and agricultural development. Such farmhouses on this land as are available for patients have been in use during the past year. The experience of Massachusetts justifies us in declaring that the colonization of the inebriate and drug habitué, as thus far practiced, is elastic and permits of differentiation, segregation, and individualization, which are essential factors in carrying out the proposed plan. As a necessary adjunct to this scheme, particular mention should be made of the Massachusetts State Farm, which has for a considerable period of time successfully cared for cases of drunkenness sent there by the courts on indeterminate sentence. Attention is called particularly to the State probation commission, which by its hearty cooperation will send a considerable number of cases to the colonies. It is intended that the new hospital shall care for noncriminal cases of drunkenness, and that the State farm, as heretofore, shall receive criminal cases of drunkenness and in addition those cases which do not submit to the discipline of the hospital. It is believed that this system will be retroactive; that it will successfully care for all cases of drunkenness which are brought before our courts for arraignment and will also offer ready help to the man who on his own initiative invites treatment for his weakness. The male department of the new hospital in process of erection will receive, first, patients who come voluntarily or who are committed upon application by the court under the existing law; second, young habitual drinkers, placed on probation by the court on condition that they spend a specified period at the hospital; third, suitable cases transferred on parole from the detention colony. The department for women would receive, first, patients who come voluntarily or are committed on application; second, cases placed on probation by the court on condition that they spend a specified period at the hospital.

The detention or custodial colony, widely separated from the hospital colony, would receive noncriminal habitual drunkards from the courts on indeterminate sentence or commitment.

The commitment of a case of drunkenness to the hospital removes the stigma of a prison sentence, thus insuring the cooperation of the patient, if this be possible, and relieving his family of the disgrace which necessarily follows a prison sentence.

It is believed that this plan for the colonization of noncriminal cases of drunkenness, with proper segregation of the types, will facilitate the study of contrasts in cases, and, by furnishing opportunity for scientific study, will contribute to medicine and society new and important knowledge for the better study of the problems of drunkenness.

THE PREVENTION OF INEBRIETY: COMMUNITY ACTION.

Mr. Robert A. Woods, South End House, Boston, Mass.

Alcoholism has been thought of almost universally as a weird, inscrutable, disconnected phenomenon, coming into human life as by a curse, and to be eliminated, if at all, only by a curse of still greater destructive power.

The view of many medical men seems to differ from this popular conception merely in their refusal to believe that any such overmastering curse can be invoked. But medical science is now beginning to tell us that inebriety is simply an accentuated projection (reacting upon itself) of a morbid state of body and, particularly, of mind; an artificially heightened outcome of a complexity of disturbed functions which reach in subtle and endless detail through the entire physical and mental organism.

The new profession of the social worker, as to this tragic matter, is also much behind the conclusions of social science and the practical logic of its own labors in allied fields. Alcoholism, as contrasted with all other community problems, is viewed as having an essentially extraneous origin; as if some evil divinity had thrown vitriol in the face of humanity; as if not only alcohol but alcoholism in its relation to the human organism, individual and social, resembled an extrinsic chemical rather than an intrinsic biological influence; and, therefore, while certain scattered precautions may be and should be taken, certain casual remedial action sought, there is not much to be hoped for until the race can contrive, through centuries of general progress, to attain wisdom and power sufficient to escape this unintelligible and unassailable foe.

Medical practice has begun to emerge from a point of view with regard to alcoholism which was essentially the same as that which was held a century ago with regard to insanity. Social science, including public medicine, must now very determinedly lay aside an attitude toward alcoholism which closely resembles the conception of the plague which came down from the Middle Ages. The plague was called the " act of God." Measures of prevention were not developed, because they were considered beside the mark, and even impious. Through the combination of forces and methods which this congress represents the plague has to all intents and purposes been abolished. The methods of the twentieth century science of social hygiene—confident, adventurous, exhaustive diagnosis of community conditons, and as confident, adventurous, exhaustive treatment specifically directed at every turn to meet the indication of the diagnosis in terms of community action—dealing with the origin and processes of every injurious social inducement, and ingeniously manipulating every conceivable preventive or protective social resource—these things will bring in an entirely new stage of hope for the not distant disintegration and dissolution of the physical and moral scourge of alcoholism.

A thoroughgoing community system of prenatal care and instruction of mothers in the nurture of infants will, in any neighborhood, bring into the kindergarten an obviously better type of child than came from the same families four years before. Medical inspection, associated with nursing care, in the public schools will mean that the entire mass of the children in a community will, as it were, be passed through a hopper and will come out cleansed of that list of easily removable physical handicaps of eye, nose, teeth, and throat, which for earlier generations have meant a steadily growing repression of vitality and power of resistance. The establishment and progressive administration of public baths, gymnasia, and playgrounds, with the provision of substantial yearly country vacations for every city child will, as experience clearly proves, bring the adolescents of a community on into maturity upon an unmistakably higher physical and moral plane.

The intimate connection of alcohol with recreative association constitutes one of the chief sources of its power. This evil complication, once established, is only very slowly disentangled. The so-called substitutes for the saloon will not draw away those for whom the infusion of alcohol into sociability has become an ingrained passion. But the many forms of intelligently directed association among the young—in which the teacher and leader acquires telling influence by keen and intimate participation with his pupils—are creating a definite self-respecting recoil from any beginning of saloon companionships. It is impossible to estimate the value of a social sentiment of this type.

Every phase of formal and of informal education needs more than ever to be charged with the wise impartation of ethical principle and ethical sentiment as a buoying power to keep young men above those states of mind in which alcohol has its most seductive appeal. The minds of our youth should be supplied with the antitoxin of sane and clear information about alcohol. There is, also, very much to be expected from the growing movement for sound instruction in sex hygiene; this on account of the strong evidence to show that sex perversion and alcoholism pursue each other in a literally vicious circle.

The rapid extension of industrial training is of high value in establishing from childhood a better balance of mind and temperament by bringing to the surface powers and interests which would otherwise remain quiescent or even become an internal disturbing force, by integrating the young person at a much earlier age with the concrete demands and opportunities of life, and by creating a true basis for judging between the productive and destructive tendencies in one's nature.

There is substantial evidence to prove that an advancing wage standard, a shorter working day, an ample and better-prepared dietary, and a home with adequate space, light, and air conduce specifically to a temperate life. Twenty-five years ago it was often urged that the granting of the laborer's demands would mean only so much more time and money to be spent at the saloon. To-day no one refers to that gloomy prediction. It is becoming a commonplace that better opportunities in life distinctly tend to protect the workman from alcoholic allurement.

It is an obvious fact that to-day in many forms of industry and trade men are compelled to choose between indulgence in liquor and success in their vocation; while the complexity and intensity of business is each year, by practical test, in constantly increasing instances leading to the elimination of the alcoholic habit. It is well known that a large proportion of practical politicians, including those without standards of public morality, are total abstainers. Trade-union leaders are held more and more strictly by their following to a life of sobriety under the very practical consideration that, unless their heads are clear, the leaders can not hold up labor interests against employers and their attorneys.

Practical moralists in ever-increasing numbers are counting in the element of risk to one's self and to others as easily sweeping away the thin margin of utility or permissibility to which recent medical conclusions limit the use of alcoholic beverages. It is thus, with growing assurance, that the doctrine of total abstinence is being carried through all the channels of systematic education, of recreative association, and of religious loyalty. The Roman Catholic Church has shown markedly encouraging progress in temperance propaganda directly through its total-abstinence organization and indirectly through a very numerous society pledged to purity of speech.

The development of the scientific medical study and treatment of inebriety, in both its personal and community bearings, is disclosing important principles which in due time can be applied to preventive effect in connection with all phases of work for social betterment. That the secret of most cases of inebriety is in disturbed emotional states, associated nearly always with disarranged social relations, indicates the great preventive value of those intimate, sympathetic contacts in the home and in the local community which are established by workers connected with churches, organized charities, settlement houses, and nursing associations. It is to be expected that the time will soon come when the precise types of disturbance which are likely to lead to alcoholism or other forms of degeneracy will, particularly through the agency of the public schools, be accurately and systematically detected and eliminated during childhood and adolescence.

In the various forms of friendly association among the well to do, including the clubs of business and professional men, there is ample reason to believe that the increase in the consumption of liquor, which was noticeable as recently as 10 years ago, has received a distinct setback. This in part on account of the increasing practical conclusions that come out of business experience, but probably even more largely from the very marked shifting of medical opinion in the direction of complete abstinence or very marked moderation.

The segregation of inebriates in special public hospitals, for temporary treatment or permanent custodial care, is, from the community point of view, a preventive as well as a remedial measure. Alcoholics are very commonly possessed with the desire to get others to drink. They are serious sources of moral contagion. Another phase of institutional progress, which will also constitute an important preventive influence, is the identification and segregation of the feeble-minded, who undoubtedly go to make a substantial proportion of the alcoholics.

The ever-growing sense of the needless waste of life and power through disease, accompanying the triumphant progress of medical science in checking that waste, is bringing about a truer valuation of the damage done by alcoholism, and a more unqualified purpose to reach, somewhat as the sources of the great bacterial diseases are reached, the seed germs of this disease, figuratively speaking, and all that make them thrive. The whole matter has become at once more challenging and more tangible, as drunkenness itself has come to be classed as, in many senses, a disease rather than a mere vice, and as it has been more clearly brought out as so largely opening the way to the two great human woes upon which medical science is now so keenly turning its inescapable eyes. I refer to venereal disease and insanity. These considerations must greatly strengthen the contributing interest in the movement against alcoholism among the medical profession and among trained social workers.

Experience in the great community campaigns against tuberculosis, yellow fever, and hookworm disease, indicates not only that every ingenious precaution must be taken to secure a sound state of internal vitality and proper ordering of the general environment by way of effective prophylactic policy, but that, if necessary, whole communities must be turned inside out in order minutely and exhaustively to disinfect all the sources from which the actual provoking unit of disease comes. A study of the prevention of inebriety is far from following the beacon light of science if it stop short of any of the stages that may be necessary in the mighty task of eliminating all injurious dissemination of alcohol.

The regulation and restriction of the liquor trade is based on deeply established principles of government and upon long experience. As a general policy it is to-day reenforced by the increasing governmental tendency to control various forms of more or less unserviceable business in the interest of the public as a whole, and without regard to the choice of the individual. Recent legislation against impure food and patent medicines is indirectly serving to push forward the intrenchments of the movement for temperance legislation.

In communities where the saloon is and for long will be firmly established, especially in large cities, we must learn to look upon it not as a crude, amorphous institution, but as an intricate, complicated system of varied and diverse functions. All of this functionizing of the saloon business must be patiently studied and dealt with in detail. Among the steps that have either proved their value or offer good prospects of limiting the saloon as a producing source of inebriety are: the limitation of the number of licensed places; the placing of saloons apart from the homes of the poor; no sales on Sundays and holidays; the forbidding of sales to minors, to men under the influence of liquor, and to habitual inebriates; the abolition of the treating custom; the removal of all special attractions, such as free food, music, and games; the removal of all screens from saloon windows.

The State of Massachusetts forbids the sale of liquor by the bottle in places where it is sold by the glass, in this way preventing the man slightly under the influence of liquor from receiving at once a quantity sufficient to produce extreme and continued intoxication. A proposal is under serious consideration, both in England and in this country, to delay the opening of saloons in the morning until after the entire labor force of the community has gone to work.[1] A bill including this principle, applying to the District of Columbia, was before the last Congress, and received the approval of the Senate. Evidence as to the time of day in which industrial accidents occur strongly suggests the influence of alcohol taken just before the work period begins.

Careful and detailed merchandizing analysis of the liquor trade, and its regulation on that basis, means, on the economic side, the carrying out of the logic of our various commissions for the specific administrative control of all forms of business conducted under public franchise. The last great step in this direction in the United States had to do with a penetrating and drastic rearrangement of the life-insurance business. It is entirely reasonable that the liquor trade, which bears almost, if not quite, as vitally upon personal and family welfare throughout the Nation, should be the next to be thus radiated with the light of publicity and reorganized in the public interest. It is the almost universal fixed idea of the liquor licensing authorities that their function of community protection refers only to the most extreme and obvious violations of the law. The principle must be established that they exist to promote the interests of the community in every positive way which the law will allow.

It is a curious anomaly that though in many communities liquor licensees are forbidden, under heavy penalties, to sell to a man under the influence of liquor, those same communities report each year thousands of persons whose drunkenness was so extreme that it was necessary to arrest them on the streets. In the great majority of such cases the person must obviously have been under the influence of liquor when he was sold the last glass. May the time not come when our licensing boards will learn how to hold the liquor business responsible for injuries done to individuals and to the public, precisely as all other publicly licensed forms of business are held?

Such a change of front might give to our great city communities some of the advantages which are claimed for the system of the municipal ownership and administration of the liquor traffic. The two considerations which appeal to many in favor of this system are that it removes from the liquor seller the inducement to sell to his customer any more liquor than the customer himself was moved to ask for and that it eliminates the corrupting influence of the liquor business from our political and commercial life. It seems entirely likely that, with 46 Commonwealths all experimenting in social legislation, the public-management system will receive a substantial further trial in this country.

The recent vast extension of the movement for State and local prohibition in the United States represents a most impressive growth of the conviction that the social and moral dangers of intemperance must at any cost be comprehensively reached and intercepted. There is substantial agreement among disinterested citizens throughout the country that, outside of the large cities, local prohibition, preferably by towns, is sound public policy, and is justifying itself in its preventive, if not in its corrective, results. As to States where prohibition is at present in force there is among good citizens a divergence of opinion. The basis of doubt refers chiefly to city conditions in these States; and it seems likely that we shall see, in some of these States having cities of substantial size, a concession in favor of a system of licensed regulation of the sort just outlined for these cities. The contention that prohibition should not exist unless the law can be quite fully enforced is most strongly urged by the liquor interests, which are, as a matter of fact, actively involved with the violation of prohibition laws of all sorts. What chiefly concerns them is that, in prohibition territory, as a rule, a distinctly less amount of liquor is sold than under license.

The intrenched political influence of the liquor trade stands over against a steadily growing movement among the voters toward its closer and closer restriction. One of the new and most significant facts in American politics to-day is the silent, desperate rush of the nationally organized liquor interests into one State after another to prevent the large increase of the voting power against them which will come with woman suffrage. This tendency toward the reenforce-ment in the electorate of the vote for the drastic restriction of the liquor trade will undoubtedly bring in a new phase of the movement for prohibition. In this new phase scientific men will play a significant part. A year ago a petition was submitted to the voters of the State of Maine urging that the experiment of State prohibition should be steadfastly continued. This petition was signed by some hundreds of men of the highest academic authority and the highest professional reputation in various branches of physical, medical, and social science in Europe and America. This petition is not mentioned for the sake of urging the claims of prohibition, but to show that men of science are already reversing their judgment that it is inconsistent with their attitude toward the fact of life to participate actively in the efforts for the social control of alcohol.

The science of medicine has long included a department of medical jurisprudence. Public medicine axiomatically involves legislation and the administration of law in the interest of the public health. The widespread, deeply rooted, and continuous social epidemic of alcoholism can offer no exception. The fact that, as a field for public medicine, it has been quack-infested can not be a deterrent; and the great profession, which has furnished its willing martyrs in the contest with every other form of widely prevalent human ill, will surely not hesitate in the honest, penetrating, exhaustive attack, because there are conflicting phases of clouded and prejudiced public sentiment to be invaded, and because the specific toxin of the disease, instead of propagating itself, has its destructive power everywhere strangely reenforced by an inconscionable human instrumentality, the subtle, pervasive ingenuity, and the fanatically self-seeking purpose of a great, nationally organized business enterprise.

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[1] This principle has recently been adopted in Birmingham, England.

GARDEN CITIES.

GEORGES BENOIT-LEVY, General Secretary French Garden-City and Town-Planning Association, Paris, France.

Under such a title, Mrs. Esther Matson, one of the American women most prominent in civic betterment, wrote in the American City:

> Phillips Brooks once said: "The Bible shows how the world progresses. It begins with a garden, but ends with a holy city."
>
> Were he living to-day he would doubtless lend a helping hand to the world-wide interest in creating better cities on this our earth. Possibly he would then paraphrase his own sentence to the effect that human progress begins with a garden but culminates in a garden city.

Whatever road the social reformer or the public hygienist follows, he is bound to come back to garden cities, which typify the most sanitary arrangements of life, either from a material or a moral point of view.

We know by experience that in most of our old cities in Europe the problems of microbiology, of hygienic physiology, of disposal of sewage and wastes, of hygiene of infancy and childhood, and, in one word, of the multiple questions which are on the program of this congress, are met with the greatest difficulty, owing to the anarchic way our towns have grown up.

We can not change the past, we can not burn out our old towns; we may improve them from time to time as opportunity arises, but our most sacred duty is to prevent for the future such a devilish disorder.

Let us, first of all, make the new parts of our towns, the suburbs and the new cities of our lands, on such plans that we may have garden suburbs and garden cities. Forest Hill, of the Russell Sage foundation in Long Island, or Forest Hills laid out by Pope and Kilham in Massachusetts, in the United States, and Hampstead, in England, give a fair idea of what a garden suburb is. In Letchworth (Hertfordshire) we are able to appreciate what a model community built "with a purpose" means in health and in prosperity. Think of it! One hour from London, on land which seven years ago was nothing but green pasture, stands now Garden City, with thousands of homes, with 40 absolutely smokeless factories, and with an intensive civic life. The reward of a city built with a plan is an infant mortality not exceeding 38 per 1,000 and a general mortality a little less than 5 per 1,000.

May it be also mentioned that at Garden City there is no house of more than two stories, each of them surrounded by a garden. As has been forcibly demonstrated in previous congresses by M. M. Rey and Aldridge, "The best way to avoid the slums is to prohibit the tenement." In planning ahead let us build our cities with cottages, with homes, and not with barracks.

I am not going to undertake the description of Garden City, which is already well known, and to which I have devoted a book of 300 pages,[1] but I will call the attention of the congress to a fact of minor importance for the world, but of great significance for my own country—the building on modern lines of a model industrial community in the north of France.

For many years past French manufacturers have concerned themselves with the building of sanitary houses for their workingmen, and at that point of view a splendid philanthropic result has been accomplished in our country. As I do not speak now before a congress of philanthropists, but of scientists, I will limit myself to the description of the new industrial community built by the mining company of Dourges, because if there are philanthropic motives in the creation of it, there is a scientific method in its planning which can be set up as an example.

Dourges, as we call it, is an ensemble of elegant and harmonious curves of streets planted with trees and bordered with turf, of cottages of various hues, which give an impression of freshness, of health, and gaiety. In the arrangement of the village the points of the compass have been taken into account, so that each cottage has as much sunlight as possible.

Let us look at one of the village streets. Here is a road 5 meters wide, with two sidewalks, each 3.5 meters in width, of which 1.5 meters are macadam and 2 meters turf; the boundary line between the sidewalk and the front garden is not marked by fences or railings, but by borders of flowers; the front gardens are about 4 meters in depth. This makes, therefore, an avenue about 20 meters wide between the houses, planted throughout its length with trees, acacias, plane trees, and sycamores. From point to point at the crossroads the eye is charmed by groups of ash trees, evergreens, or rosebushes. In the rear of each cottage is a garden covering about a tenth of an acre.

The builders of the model village of Dourges have tried to retain the influence of the form, the picturesqueness, of the old French village, and at the same time to profit by the hygienic and sanitary ideas of the modern city.

The cottages.—The cost of the charming cottages varies from $840 to $900. The walls are built of country-made bricks, joined by white cement; they are 35 centimeters thick. The corners are of artificial stone made of the same clay. We see that simply by joining the bricks with this white mortar and decorating them in different colors a varied effect is obtained with little change of plan. In the interior the walls, instead of being papered in bad taste, are tinted in gay tones at very little expense, and have an attractively decorated frieze of washable paint.

Entering one of the cottages we find below us a paved cellar for wine and provisions; on the ground floor a porch, a vestibule, a living room 4.5 by 4.5 meters, and a bedroom for the boys; on the floor above is a bedroom for the parents 4.5 by 3.6 meters, and one for the daughters of the family 3 meters square. Under the roof, so that not a bit of space is wasted, we find a garret for drying clothes.

Every room in the house is paved with tiles, so that the floors can be flushed; all the walls have rounded corners, in order that no dust may gather there. The ceilings are of reinforced concrete, supported by iron T bars.

To secure constant and abundant light and ventilation the windows take up one-sixth of the surface of each room. They open outside so as to keep out the rain and to take up less room. There was one problem to solve—how to arrange the laundry, the coal shed, and so forth, without destroying the general harmonious look of the cottages. This has been accomplished by connecting the laundry (which serves also for a bathroom for the miner when he comes home) and the coal shed, as well as the toilet, with a porch. This porch makes a sort of outdoor summer dining room, where the family can eat under shelter in the open air on pleasant days.

The sewage from the toilets is conducted into septic tanks, where it is chemically treated. There is one tank for each house.

It seems almost wonderful that such a plan should be so well accomplished; but it is due to the perseverance and the distinguished work of the architect, M. E. Delille, who has attained this result only after the most careful study.

It is not only the general aspect of the garden village of Dourges which charms the visitor, but anyone who spends some time there is profoundly interested in the numerous social institutions which have sprung into life along with the model village, and which have been developed through the generosity and the intelligent initiative of the mining company of Dourges and its directors. The statements impress upon us the fact that the art of city building influences, not only the betterment and the health of the people, but also the entire social organization.

I have desired, in this short communication, to give but a single example of the movement which is taking place in France in the way of city planning. I might add that in various parts of our country other signs of this movement are to be noted. In Paris, a town-planning commission has been nominated by the municipal council, and, thanks to the activity of Mr. Louis Dausset, the ancient fortifications and their zone are to be turned into 1,200 acres of parks and playgrounds. The Ligue des Espaces libres (general secretary, M. Mourgues) and l'Association des Cités-Jardins de France have helped much by their propaganda for that last scheme.

In Lyons, a municipal town-planning commission has just been nominated by Senator Herriot, the mayor, and it may be well to let the world know an international exhibition of "The Modern City" will be held in 1914 in Lyons on 64 acres of magnificently situated ground.

In Nancy the Society of Manufacturers of the East of France is opening a competition for replanning a whole district of that city.

And may I not mention that if, beside Haussmann's work, we have been a little sleeping in the last century, the idea of planning a town for her health and beauty has, in the past, originated from France, one of the best instances being your beautiful Federal Capital, in the laying of which Major-L'Enfant helped General Washington.

Now, we have come at last to see that the planning of the city is at the root of all sanitary problems.

Nations are borrowing, one from the other, these new ideas. I do not forget what has been done in the United States. I believe that, thanks to such powerful organizations as the American Civic Association, as well as all the societies connected with it, whose object is civic uplifting, the Americans will be, before long, in advance of Europe in all that concerns the beautification and healthfulness of their cities. In fact, in laying out their unique park systems, they are making all their municipalities in greater or less degree into garden cities.

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[1] An illustrated catalogue of the books on garden cities and town planning may be had on application at l'Association des Cite's-Jardins de France, 11 rue Malebranche, Paris.

MODERN TOWN PLANNING.

Sir GEORGE McCRAE, Vice President Local Government Board for Scotland, Edinburgh.

The development of town planning on scientific lines is being followed with increasing interest, both in Europe and America, and the experimental results already attained are being carefully weighed in the balance of an economic standard.

From the economic standpoint, it is a truism to say that the more strenuous the conditions of human life become, the more necessary is it that the human machine should be worked under conditions as nearly perfect as possible.

Only under such conditions will it be able to stand the strain and be fit to work efficiently.

We must realize to the full that, under the competitive conditions of modern existence, it is only the perfect machine which will be able to produce satisfactory economic results.

The vital importance of town planning, of which good housing is a most important part, is evident, whether we consider the general health and well being of the community, or the conditions necessary to enable the individuals thereof to produce the best and most productive economic results.

HOUSING AND STREET PLANNING.

Town planning naturally divides itself into two main branches, housing and street planning. As the housing problem is being treated in a separate paper, I intend to deal chiefly with the problem of street planning.

It may confidently be assumed that theoretical adherence to economic, esthetic, and hygienic considerations will receive general assent.

But however logical these propositions may be theoretically, the practical man asks the questions, Can town planning be made to pay? Will the already severe strain on municipal revenues be increased to breaking point by its adoption?

And perhaps it is quite a fair criticism of our more enthusiastic advocates of garden city schemes to say that they have devoted themselves too much to the esthetic and too little to the practical side of the question. Recently, however, this defect is being remedied. I would go so far as to say that, if we wish to produce the best economic results in municipal government, it will pay to scrap our old machinery.

That process is invariably carried out at an immediate loss. The business man must often mortgage his future in incurring expenditure, and has to wait for a longer or shorter period before he gets a return in the golden harvest of realized ambitions.

What is true and so self-evident as regards the individual, is no less true for the community. That this is being realized more and more by our national and municipal governments during the last few years is proved by the keenness with which town planning, in its economic development and in its relation to public health, is being studied scientifically by those interested in local government.

Nor is this great awakening confined to one continent, although I think it is fair to say that America has not shown her characteristic go and enterprise in appreciating the economic advantage of town planning from the purely commercial side. In October, 1910, a great town-planning conference and exhibition, attended by delegates from various countries, took place in London, at which cartoons of town planning from all parts of the world were exhibited. Some of these cartoons came from your own beautiful city of Washington, with its splendid public buildings and its magnificent boulevards; others from the new city of Khartoum, which owes its origin to Lord Kitchener, who presided at the lecture describing its development.

Austria and Germany showed the products of their well-equipped town-planning departments. Those departments filled me with envy when I had the pleasure of visiting them.

Since then we have had exhibitions and conferences in Glasgow and Edinburgh.

Town planning, to be of real scientific value, must not only regulate the development of future communities. It must also, so far as is possible, retrieve the blunders of the past. The latter is generally a most expensive business. Still it must be faced.

But hitherto there has been no scientific and considered line of advance. In Britain attention was being devoted to, and large sums of money were being spent on, the old quarters of our cities while, at the same time, development of new areas was allowed to take place on the old, bad, haphazard lines, which can only result in a repetition of those same vicious conditions in the future which we are now at such enormous expenditure dealing with in the older parts of our cities.

It is not too much to say that it is costing Britain millions of pounds sterling to clear away slum areas for the improvement of the conditions under which the poorer classes live, due to the defective town planning of the past, and yet in many cases it has missed the opportunity afforded it when new developments took place. It has unfortunately not appreciated the inestimable advantage of being able to deal with the problem on virgin soil, untrammeled with the complications of vested interests.

It is not, I think, unfair to say that, on the continent of Europe, housing of the working classes has been subordinated to well-planned boulevards and magnificent Strasses.

In Berlin and Vienna how one is impressed with the magnificence of the well-planned streets and the symmetry of buildings, yet disappointed and depressed when he pierces behind the veil of imposing architecture to the squalor and insanitary condition sometimes to be found within.

I have seen something of town planning on the continent of Europe. Especially have I been impressed with the rapid development on broad and generous lines of such places as Colounge and Dusseldorf in Germany.

But, as a broad generalization, I would say that in Germany, France, and Austria-Hungary attention has been devoted to street planning, to the detriment and neglect of proper housing conditions. A change is undoubtedly taking place. In Charlottenburg and in some of the working-class districts of Berlin itself private enterprise in the form of housing societies is doing its best to remedy conditions, but a more comprehensive effort is necessary in order to adequately deal with the problems.

On the other hand, in Britain attention has been devoted to housing rather than to town planning in its purely technical sense. In saying this I am not forgetful of the many magnificent and costly schemes of street improvement so successfully carried out by the larger cities of England and Scotland.

Britain has been grappling with the housing problem more or less effectively since the passage of the working-class housing act of 1890; and under private improvement acts of Parliament promoted by individual municipalities.

But it was only so recently as 1909 that a town-planning act was passed by Parliament.

That act incorporated and consolidated the previous housing acts in addition to conferring far-reaching powers on municipalities to.

carry out town-planning schemes with the consent of the central authority.

The most recent housing scheme, which I commend to the consideration of all experts, is being carried out by the Liverpool corporation, and is, in my opinion, far and away the best and most economical and practical scheme of working-class houses to be seen anywhere.

It may safely be asserted that continental countries may learn a great deal from Britain on the question of housing. It is no less true that Britain, on the other hand, has much to learn, and is, indeed, alive to the necessity of profiting by the examples of street planning to be found on the grand scale in continental countries.

These two aspects of town planning, far from being antagonistic, are complementary to each other.

Progress, to be real and permanent, must proceed along these parallel lines of advance. Again, schemes must be far reaching and comprehensive.

Town planning ought not to be confined to towns. It is a common mistake to imagine that town planning is only necessary for and can only be made applicable to town dwellers.

Town planning should be wide enough to embrace rural as well as urban areas. Rural housing under decent and sanitary conditions is as necessary for the well-being of the community as town improvements.

Improved sanitary conditions of rural life, at least in the older countries, is in many cases as urgently needed as are slum clearances in city areas.

It may at first seem somewhat paradoxical to speak of town planning for rural areas, but, altogether apart from the question of sanitary housing, it is necessary to provide that future development should proceed on hygienic lines. The sites of our future towns must be protected from the hideous results of the past haphazard development.

Nowhere is this more necessary than on this great Continent of America, where towns spring up, like Jonah's gourds, in a night, but whose stability we trust will be more enduring.

POWERS OF LOCAL AUTHORITIES.

If these ideals are to take practical shape, it follows that extensive powers as to acquisitions of land, and restrictions as to form and height of buildings, must be vested in local governments.

Compared with its continental neighbors, Britain has, on account of its less autocratic form of government, been severely handicapped in its town developments of road and traffic facilities.

More drastic laws obtain in many German and Austrian towns for the acquisition of land for roadways, regulations as to heights of buildings, and the compulsory setting apart of certain areas for trade purposes. Necessary and justifiable as these are, they would have been considered, in our freedom-loving country, as a policy of confiscation.

But we have now realized that what was freedom of action for the few was thralldom and repression for the workers who were compelled to live in congested and insanitary areas on account of the prohibitive price asked by neighboring landowners for land surrounding our great cities.

TOWN AND COUNTY AREAS.

The two great barriers to progress were, first, the prohibitive price of land, with the attendant expensive forms of procedure necessary for its acquisition for public purposes; and, second, the hard and fast line of demarcation between town and county areas of administration; the different regulations and by-laws obtaining in each; the jealousy rarely absent existing between the town and county governments. Seldom, if ever, could these be got to unite in any well-considered joint plan of development for the mutual benefit of the contiguous areas.

The fear of annexation of contiguous county areas by the towns prevented any possibility of cooperation for joint schemes of mutual advantage.

TOWN PLANNING ACT OF 1909.

Under the town-planning act of 1909 a new departure of great moment was made; the far-reaching importance of which few, even in our own country, yet appreciate.

Under the act one local authority can submit to the central authority a scheme for the planning of new areas which may embrace land both within and without their own boundaries.

This is an enormous protection for growing cities which hitherto have been condemned to plan within the confines of their own jurisdiction; with the result that just over the border conditions may obtain which stultify their actions and retard expansion.

Moreover, under certain conditions, individual landowners can submit, through the local authority, schemes embracing, along with their own lands, the lands of contiguous proprietors also.

These other proprietors have the opportunity of submitting objections before the local inquiry which, under the act, is held by a commissioner appointed by the local government board. He can either submit an alternative scheme of his own, or press for modification of the scheme submitted by his more enterprising neighbor. The town-planning act of 1909 is applicable to England and Scotland. The central authority, to which all schemes are submitted by the various local authorities for approval, is the local government board of each respective country.

Under the powers of the act, the local government boards of England and Scotland frame their own regulations. While every effort is made by the respective local government boards to secure uniformity of procedure, the conditions of life, the systems of land tenure, and legal procedure are so diverse that considerable differences are to be found in the regulations of Scotland and England.

The town-planning act is proving a great success, and the Right Hon. John Burns, M. P., president of the English local government board, deserves hearty congratulations on the energy and ability with which he piloted this bill through the British Parliament, and the success which has so speedily attended its coming into operation.

RESTRICTION OF NUMBER OF HOUSES PER ACRE.

One of the most beneficial and far-reaching provisions of the British town-planning act is the arbitrary power given to the local government boards of England and Scotland of restricting the number of houses per acre in any given scheme, so as to effectively prevent the possibility of overcrowding.

The economic result of this will be the reverse of that which a superficial view would suggest. Instead of raising the price of land it will cheapen the price of land and enable the workmen of the future to live under more humane and healthy conditions.

This is only possible and will, if necessary, be compulsorily attainable by spreading out the area on which people are to dwell.

Much is expected also from the adequate provision of cheap transit facilities to carry workmen away from the congested areas in the center. Let me say here that I was much impressed with the facilities afforded in Berlin for workmen traveling to and from their work at a rate of 4 pence per week.

The passing of the act of 1909 will without confiscation limit the monopoly of the great landowners. They will in future have to be content with a more reasonable but more immediate rate of profit. My own view is that in Scotland. at any rate, while the landowners, by holding up land ready for development, have done well financially, they would have had as good financial returns by adopting a more enlightened policy. At a town-planning conference in Glasgow last year I commended to the consideration of the landowners of Scotland the not unprofitable maxim of the modern merchant who believes in small profits and quick returns. Now we are helping the landlord to it by a little compulsion.

The inevitable effect of the town-planning act will be a reduction in the price of land for working-class houses.

More land will be necessary for a given number of houses, and the *compulsitor* which follows the adoption of the act will compel the owner to take his profit without waiting for what, in stock-exchange parlance, is termed the "top price."

Nowhere have we more striking examples of the need for cheaper land than in my own city of Edinburgh. The poorer classes not only pay comparatively more than the richer classes, they do actually pay more for the same area of land on which they live. This they do in increased rents far above the economic, as apart from the monopoly, value of the land they occupy.

Ground rent in Scotland is in the form of an annual rent charge, called a "feu." In Edinburgh land is restricted, for the sake of amenity. For the erection of villas for the richer classes land can be got at a rent of from £20 to £40 per annum. But for the same land, if available for the building of working-classes tenement houses, the price rises to as much as £250 per annum, simply because under the old laws you could build so many houses to the acre. Little surprise need be felt when I say that in the center of Edinburgh City there are, in some parts, as many as 260 persons to the acre with a correspondingly high death rate. As I have already indicated, slums were being cleared out at an enormous cost to the rate payers. A large part of that expenditure was due to the difficulty which local authorities had to contend with of getting land at a reasonable rate to rehouse the people dispossessed by the improvement schemes. To this was added the great cost by way of compensation paid to the owners of the houses demolished.

Now, under the act, compensation is to be restricted, and henceforth it will not, as in the past, be a profitable business to own slum property.

PROGRESS UNDER THE ACT.

The progress under the act has been most gratifying. Local authorities, rural and urban, have applied to and received permission from the Local Government Boards of Scotland and England to proceed with many schemes.

The most interesting scheme of all is one at present being considered by the Scottish board. Unique in its features, it is perhaps the greatest opportunity ever presented in an old country of town planning on absolutely free conditions and on virgin soil.

The great North Sea naval base at Rosyth is nearing completion, and there a new town will arise numbering, to begin with, a population of 30,000 within the next two years. This will gradually increase.

The Admiralty have requested the Scottish local government board to supervise the creation of this new community, and this interesting experience is being watched with close attention by town planners everywhere as an experiment big with results for the future of the movement. When I say that the scheme under consideration embraces an area of 6,000 acres, an idea will be had of the future magnitude of this new era. The scheme is being prepared by the city of Dunfermline, and is to be submitted for approval or amendment to the Local Government Board of Scotland.

Although the act has only been in operation for little over two years in Scotland, no less than 23 schemes are in various stages of progress. In England the success has been equally marked.

But the progress of town planning in Britain is not to be judged merely by the number of schemes coming officially before the Local Government Boards for approval.

The very fact that the central authority has power under the act to compel a local authority to make a scheme has had the effect of raising the standard of building and roadway conditions all round.

In some cases the local authority may consider that a town-planning scheme can be adopted in agreement with the local landowners. The landowner himself may meet the requirements of the act without going through all the procedure, which means considerable delay. This has been notable in cases in Scotland, where mining villages spring up rapidly when new coal fields are discovered. In one instance—at Kirkconnell—in Dumfrieshire—a new colliery village was planned on the most enlightened lines, and so much was the Local Government Board satisfied with the scheme that we wrote to the colliery proprietors officially congratulating them on their enterprise and public spirit. More expensive to begin with, I believe that the economic results arising from the better conditions under which the miners will live will amply repay the proprietors for any extra outlay.

It is, however, always advisable where possible to proceed under the act, as the local authority is thereby endowed with much greater power of control.

PUBLIC HEALTH ASPECT.

I have considered it unnecessary in this gathering of experts on public health to emphasize the importance of town planning from that standpoint.

My endeavor has been to show what is being done in Britain and, if possible, to still further stimulate the growing interest which is being evinced in Europe and America in the scientific study of town planning.

I have not dwelt on the necessity of an æsthetic objective in all modern town-planning schemes. The chessboard pattern of New York, for instance, should be avoided.

Sanitary houses, wide streets, with several tracks, where possible, for the different kinds of traffic, with tree belts, should secure alike the safety and æsthetic development of our great cities.

Again I say it will pay to do these things, and local authorities, with financial burdens more or less heavy, will find that it will be cheaper in the end to take the long view and by paying the increased cost for the present avoid the far more onerous burden of a future indemnity in the cost of clearing away slum property, not to speak of the toll of an avoidable excessive mortality.

How far the State should be called upon to assist in this matter is a question for the consideration of the different countries.

The cost of town planning should not be prohibitive to any well-governed community. Let us hope that the various municipalities of the world here represented will realize their responsibility for the good government of their cities by conserving and preserving the health of their respective communities and by raising to a still higher level their conception of the ideals to which they may attain—ideals within measurable distance of attainment to those willing to strive for their realization.

LA CITÉ HYGIÉNIQUE DE L'AVENIR; DES MÉTHODES SCIENTIFIQUES DE SON TRACÉ ET DE SA CONSTRUCTION.

A. AUGUSTIN REY, Membre du Conseil Supérieur des Habitations (Ministère du Travail); Membre du Conseil Supérieur de la Petite Propriété Rurale (Ministére de l'Agriculture); Membre Correspondent de la Commission Internationale contre la Tuberculose.

Sous l'évolution de circonstances pour ainsi dire organiques, les villes, à l'heure actuelle, continuent à s'étendre sans cesse.

Dans cette évolution qui dépeuple les campagnes, que rien ne semble pouvoir sérieusement enrayer pour le moment, quelle doit être la direction la plus sage à suivre?

Les conditions climatériques de chaque pays doivent, avant tout, créer la manière d'habiter des peuples.

C'est le facteur principal qu'il ne faut jamais perdre de vue. On est si pressé d'aller vite en besogne de nos jours, que l'on oublie un peu partout les principes élémentaires. La preuve en est dans cette

soif d'appliquer, en bloc, à un pays ce qui se fait dans un autre, sans se donner le temps de réfléchir à l'insanité de pareilles conceptions.

On ne saurait assez s'élever contre la théorie du "five-minute system," qui consiste à copier vivement, en rentrant chez soi, ce que l'on a vu faire chez le voisin. Cette théorie a fait commettre à nos civilisations erupéennes trop d'erreurs pour qu'il ne soit pas inutile d'en signaler le réel danger.

Ce qu'il est précieux de dégager, lorsque l'on discute ces vastes questions dans des congrès internationaux, c'est l'intérêt fondamental qu'ont les peuples à tracer à l'avance avec méthode le plan des aggrandissements futurs des cités. Cet intérêt se concentre presque tout entier, d'une part, dans l'augmentation des dépenses directement utiles à la santé et au bonheur des peuples et, d'autre part, dans la réduction de celles qui ne profitent qu'à une infirme minorité.

Un homme augmente-t-il son pouvoir vital en se mettant sur les épaules une lourde masse de plomb, au lieu de se couvrir d'habits chauds? Il en est de même des habitants d'une ville.

Les dépenses qui incombent à une communauté dans l'organisation générale d'une cité peuvent se classer sommairement en quatre catégories:

1. Prix du terrain occupé par les voies publiques, les espaces libres, les services et bâtiments publics.

2. Prix de construction des rues, des canalisations de tous genres, servant aux services publics et particuliers, l'aménagement des plantations.

3. Prix de la construction des bâtiments destinés à la marche des services publics et celui de leur entretien.

4. Dépenses concernant strictement l'hygiène et la beauté des différentes parties de la ville.

Le budget des cités ne cesse d'augmenter. Le chapitre relatif aux prix élevés à payer pour l'achat du sol, pour la création de voies publiques, élargissement de voies de trafic devenues trop étroites, le gros chapitre des expropriations, construction de bâtiments pour les services généraux de la ville établis généralement dès le début sur des terrains trop exigus, absorbent de beaucoup les sommes les plus élevées.

Il ne reste alors, dans ces budgets obérés, pour les services concernant l'hygiène et la beauté de la ville, que des sommes absolument insuffisantes. C'est là que réside une des causes principales de leur mauvaise hygiène.

Lorsque l'on examine de près les conditions d'existence des habitants des villes, on est forcé de la trouver basée sur une valeur le plus souvent fictive, donnée à son sol.

Il est profondément déraisonnable de vouloir perpétuer cette conception de la propriété qui consiste à laisser sans entraves monter indéfiniment la valeur du sol sur lequel s'est établi et se développe une cité. Ne voit-on pas que ce sol à valeur fictive est la base économique du logement humain.

Y a-t-il une excuse valable à laisser s'enrichir un très petit nombre de propriétaires du sol au détriment de la santé publique tout entière! Les spéculations du sol urbain sont contraire à l'intérêt général. C'est à cette spéculation purement fictive qu'est, en effet, due l'impossibilité d'arriver, sans des dépenses collossales, à l'assainissement des vieux quartiers des anciennes cités.

Le cottage anglais est fait de l'absence de la grande spéculation sur le sol. C'est une des grandes gloires nationales de l'Angleterre! La maison à étages des Etats-Unis d'Amérique est basée au contraire sur la spéculation absolument folle dont le sol est l'objet. Et malgré la manière géniale dont le problème de construction est résolu, ces édifices gigantesques constituent une monstrueuse hérésie économique.

Doit-il y avoir hésitation à prendre parti, nous les défenseurs de l'hygiène des cités, dans cette lutte magistrale que se livrent ces deux armées opposées? L'une veut maintenir le terrain à bas prix et comme conséquence la maison familiale. L'autre veut en faire un vil objet de trafic, en encourageant toute les spéculations dont il est l'objet et qui ont pour dernière conséquence les maisons blocs à nombreux étages, où vivent entassées et s'étiolent des millions de familles.

Pour toute civilisation qui place au premier rang la santé publique et non la fortune de quelques-uns, aucune hésitation n'est possible. Il faut restreindre et mettre des entraves à la spéculation sur le sol des villes.

Au dernier Congrès International d'Hygiène et de Démographie de Berlin, en 1907, ces considérations ont fait l'objet d'une importante discussion qui a suivi notre communication: "La spéculation sur les terrains dans les grandes villes." Il a été démontré que pour améliorer les conditions d'existence des citadins, il faut les pousser à la réserve d'espaces libres. Les municipalités doivent avoir en leur possession le plus de terrains possibles.

L'autorité municipale, qui représente les intérêts supérieurs de l'hygiéne publique, a un degré autrement plus grand que l'Etat, a un intérêt capital à voir ce produit de toute première nécessité qu'est le terrain, ne pas augmenter de valeur dans des proportions déraisonnables.

Pour parvenir à ce résultat, les municipalités doivent:

1. Garder jalousement en leur possession tous les terrains qui leur appartiennent, sans jamais les vendre. Ceux qui ne leur reviennent

pas à un prix élevé et ne sont pas destinés à la création de parcs et jardins publics, doivent être loués à des baux de très longue durée et aux prix les plus réduits, pour faciliter la construction d'habitations entourées d'espaces libres et permettant d'y loger, à petits loyers, la grande classe des travailleurs.

2. Les municipalités doivent saisir toutes les occasions qui se présentent pour augmenter leur domaine en achetant, suivant les circonstances et à bon marché, de nombreux terrains à grande surface. Mais les municipalités ne doivent, que dans des cas exceptionnels, jamais construire elles-mêmes les habitations.

Le Congrès de Berlin, à la suite de notre communication vota la résolution suivante:

" Le Congrès est d'avis que le nœud de la question des habitations économiques et hygiéniques des grandes villes réside dans la considération du terrain.

" Qu'il lui paraît de la plus haute importance que, pour combattre les effets de la spéculation sur le sol des villes, les municipalités, à qui incombe la défense des intérêts supérieurs de l'hygiène publique, s'assurent la possession d'une étendue notable de terrains à bas prix pour en user au mieux, suivant les circonstances particulières à chaque pays, pour l'amélioration rationnelle des conditions de l'habitation.

" Il considère que le type d'habitations qui réalise le mieux ce but est celui de la cité-jardin."

Le terrain à bas prix est la source primordiale du bien-être et de la santé des habitants d'une ville lorsqu'il n'atteint pas des prix trop élevés. Il devient, au contraire, une source de misère sociale lorsqu'il fait l'objet de spéculations abusives.

En possédant d'importantes surfaces de terrains, les municipalités peuvent remédier, sans violence, à ce fléau moderne: La spéculation du sol.

Non seulement elles préparent ainsi pour l'avenir une base raisonnable pour les expropriations d'utilité publique, car les municipalités sont actuellement mises à la rançon lorsqu'elles sont obligées d'avoir recours à ces opérations ruineuses, mais elles se trouvent surtout en mesure d'assurer, par ce moyen, pour l'avenir, des espaces libres considérables et inaliénables.

A cette occasion on ne saurait assez citer l'exemple frappant donné par la ville d'Ulm dans le Wurtemberg, grâce à l'énergique direction de son maire, M. Wagner. Les terrains considérables que possède cette cité lui ont permis d'éviter le renchérissement du sol. Les habitations y ont peu d'étages et sont entourées d'espaces libres très importants; il en est résulté un abaissement sensible de la mortalité générale et notamment une mortalité tuberculeuse très basse. La situation de cette ville est très brillante.

L'exemple frappant de logique et de tenacité donné à Ulm par M. Wagner mérite d'être répandu. Par cette politique du terrain maintenu à bas prix, cette cité a trouvé ainsi le moyen de faire bénéficier l'ensemble des citoyens, dans la plus large mesure, des avantages qui reviennent généralement à une minorité de propriétaires du sol. Dans ces conditions, lorsqu'une hausse normale des terrains urbains se produit, comme conséquence de la prospérité générale, c'est l'ensemble des habitants de la ville qui en bénéficient et voient leurs charges d'impôts diminuer progressivement.

Dans les principaux pays du monde civilisé, où les dangers hygiéniques de l'agglomération surpeuplée et où la haute mortalité tuberculeuse se font de plus en plus sentir, le grand intérêt est d'enrayer la spéculation et de rendre impossible les hauts prix des terrains destinés à l'habitation.

Les difficultés que rencontrent les prescriptions de l'hygiène publique urbaine ont presque toujours pour point de départ le terrain et la valeur fictive qu'on veut lui donner.

Pour obtenir des espaces libres autour de l'habitation, c'est sur ce point que doit porter tout l'effort. Une municipalité qui possède beaucoup de terrains qui lui reviennent bon marché, surtout dans les parties où la ville s'étend le plus, peut espérer contrôler, dans une large mesure, le marché qui fixe sa valeur.

La spéculation du sol est une des causes directes des charges d'assistance dont le budget de nos grandes villes voit le chiffre s'enfler d'année en année.

Le terrain des agglomérations urbaines, non destiné au commerce et à l'industrie, mais seulement à l'habitation, ne doit plus, de nos jours, être un article ordinaire d'échange.

Nous sommes parvenus à une période de la vie des cités où se révèle, avec toujours plus d'âpre précision, les horreurs causées par l'habitation surpeuplée. Elles ont pour origine fondamentale les agiotages dont le sol urgain est l'objet, et qui mettent l'architecte hygiéniste, dans l'impossibilité d'élever des maisons d'habitation de peu d'étages et de les entourer des espaces libres suffisants, afin que la lumière directe des rayons solaires puisse les pénétrer de part en part.

Les facteurs principaux de la contagion tuberculeuse sont incontestablement la mauvaise orientation et l'encombrement des habitations dans les grandes villes. Si l'on pouvait établir la proportion exacte qui incombe à ce second facteur dans les ruines que la tuberculose accumule partout autour d'elle, on serait bouleversé du prix exorbitant auquel revient, à la société tout entière, les spéculations du sol qui ont forcé à la construction des maisons à nombreux étages. Cette reforme dépend des pouvoirs municipaux.

C'est à eux qu'incombe, en tout premier lieu, de rechercher par tous les moyens, à améliorer la santé publique. En combattant résolument la hausse fictive du sol urbain, on pourra alors, par l'application de méthodes scientifiques rigoureuses que nous avons établies, viser à l'orientation des voies publiques, à celle des bâtiments, qui ont pour corollaire immédiat d'augmenter, pour ainsi dire automatiquement, l'espace libre au pourtour de la maison d'habitation. La grande affaire, en matière d'hygiène de l'habitation, c'est la pénétration des rayons solaires jusque dans ses moindres parties.

Ce ne sont pas des parcs surtout qu'il faut d'urgence aux habitants d'une ville, c'est de la lumière, de l'air en abondance dans l'habitation elle-même. C'est le seul remède que réclament ceux qui veulent voir baisser rapidement la terrible morbidité et mortalité tuberculeuse des grands centres.

Ces considérations ont une importance capitale lorsque l'on s'occupe du développement des villes modernes. Les constructeurs de villes doivent en faire une de leurs préoccupations dominantes.

L'architecte de villes, s'il veut concevoir un plan rationnel, doit sectionner le problème. Dans l'esprit de beaucoup, la ville est, en effet, un bloc en apparence complexe, presque inextricable. La complexité de la ville moderne n'est qu'une apparence. En effet, en examinant de près une cité, on peut classer ses besoins en quatre catégories distinctes:

(1) La vie des affaires; (2) la vie de l'industrie; (3) la vie adminstrative; (4) la vie de l'habitation.

La ville des affaires.—Il faut tout d'abord concentrer dans un nœud, ou plusieurs nœuds du plan, suivant les besoins, les quartiers où se concentre la vie des affaires, la vie de bureau, celle où se font les grands échanges, les achats, les ventes, ce qu'on appelle en anglais "the city."

L'étude de la "city" est une des plus intéressante qui se puisse présenter. Elle exige une haute expérience du besoin des affaires, qui se résument pratiquement à ces conditions essentielles, rapidité d'accès, simplicité de tracés, établissement par section des groupements d'affaires de même nature, construction en des points bien choisis et très "central" des bâtiments généraux servant aux échanges, comme les bourses, les chambres de commerce, les chambres syndicales et corporatives, sans oublier les restaurants, chose toujours si négligée.

Lorsque l'on songe combien les cerveaux, arrivant lucides le matin à leurs affaires, ont de peine à se maintenir sereins et frais jusqu'à la fin de la journée, par la faute presque générale de l'organisation absolument déplorable de la cité des affaires, une réforme s'impose.

La ville industrielle.—Il faut ensuite organiser la ville industrielle qu'il n'est pas nécessaire de répartir en trop de centres distincts. Pour être pratiques et économiques, les grands quartiers industriels ont besoin de voies de trafic spéciales, de larges routes de communication, par canaux, chemins de fer, transports électriques sur rails ou aériens. Il y a tout intérêt à mettre à frais communs entre tous les industriels, ces dépenses d'organisation et de transport si productives lorsqu'elles sont bien proportionnées aux besoins. Il y a profit évident à les amener sur un seul point au plus haut degré de perfectionnement possible.

On doit songer également â ne pas compromettre la santé générale de la cité par les fumées et les odeurs industrielles. Si la fumivorité était appliquée comme elle le devrait, dans l'intérêt même des industriels, on n'aurait pas besoin de s'occuper vers quelle orientation on doit élever cette partie de la cité. Mais il faut le reconnaître, de très grands progrès sont nécessaires. Dans presque tous les grands pays du monde, les industriels n'ont encore voulu réellement faire aucun effort décisif à cet égard.

Il faut placer cette partie de la ville au-delà des vents régnants de manière à ce que les fumées ne puissent jamais venir obscurcir en permanence la luminosité de l'atmosphère.

La ville administrative.—Ce que nous appelons la ville administrative, c'est la ville des grands monuments utiles à la communauté qui peut être voisins de ceux qui constituent sa richesse et sa gloire et contiennent ses trésors historiques, scientifiques, et surtout artistiques.

Oú faut-il la placer? Il faut l'éloigner à la fois de la cité industrielle et de la cité des affaires. Il faut la placer au centre de la vaste cité de l'habitation, afin que de tous les côtés puissent également affluer ses habitants. Cette partie de la cité peut prétendre être le centre artistique et monumental. Il serait trop long ici d'énumérer en détails les dispositions qui conviennent à cette conception éminemment moderne.

Qu'il nous suffise de dire que l'hotel-de-ville peut en occuper presque le centre géométrique. Il est bon, en développant le côté monumental de cette partie de la ville, de faire naître chez ses habitants cet amour ardent pour son sol qui est la source pure de ce grand patriotisme local, qui a toujours été si florissant aux grandes époques de l'histoire artistique des peuples. On ne peut attribuer assez d'importance à l'influence que peuvent exercer de grands monuments sur l'esprit des masses. Ils deviennent comme la représentation matérielle et tangible de l'activité, du labeur et de la grandeur de la ville.

La centralisation à outrance, qui a créé les grandes capitales, qui suce le meilleur de l'âme nationale, est une erreur fondamentale.

Dans les grandes nations les centres doivent être multipliés. Rien n'a enrichi autant le domaine esthétique des villes, dans les époques passées, que la puissante indépendance et la liberté des communes. C'est rendre service à l'idéal de l'humanité que de chercher à briser cette centralisation étroite, tracassière, anonyme, brutale et aveugle, que fait peser si lourdement sur les peuples les Gouvernements modernes.

Parmi les grands pays, l'Angleterre et les Etats-Unis d'Amérique sont peut-être les nations les plus décentralisées. L'application des lois d'organisation, de développement et d'embellissements des villes ne fera qu'accentuer ce mouvement.

La ville de l'habitation.—La dernière partie de la cité, et non la moins capitale, sur laquelle l'Angleterre et les Etats-Unis d'Amérique ont attaché la plus haute importance, est la cité de l'habitation, celle où l'on vit quand on a quitté ses travaux de la journée, celle où est le nid de la famille, le berceau de l'humanité. L'Angleterre et les Etats-Unis d'Amérique en ont créé d'admirables exemples modernes. Et il ne faut pas craindre d'apporter ici notre admiration à la lutte héroïque entamée par ces pays pour défendre leurs " cottages " contre la tentation de la maison à étages, habitation trop courante du continent européen.

Nous trouvons là un parallèle à cette lutte également héroïque sur le terrain économique, qui a fait conserver à l'Angleterre, malgré tous les obstacles et toutes les coalitions, le libre échange en opposition avec le protectionisme continental.

Dans ce domaine de l'habitation la race anglo-saxonne a montré toute l'énergie de son caractère. La seule réserve que nous aurions à faire à ces cités de l'habitation, telles qu'elles sont comprises en Angleterre, est de noyer parfois ses monuments les plus importants au hasard de milliers de ces petites constructions idéales: les cottages. Il n'en reste pas moins qu'une des gloires les plus pures de la Grande-Bretagne, c'est d'avoir fait sienne cette devise: Une maison, une famille.

La division en quatre groupements essentiels, montrant les besoins d'une ville moderne, doit être toujours présente aux constructeurs de ville, même lorsque les espaces dont elle dispose sont relativement restreints.

C'est le cas qui se présente lorsque les terrains d'extension raccordant une ville principale avec ses faubourgs ne présentent pas toute l'étendue nécessaire.

Il est souvent délicat de corriger, à ce moment-là, les erreurs du passé. Mais il est prudent, dans ce cas, de remanier le plan général des parties limitrophes construites et par des lignes d'ensemble formant un réseau bien équilibré, fixer l'amélioration qui pourra être obtenue par une exécution sectionnée et répartie sur un grand nombre d'années.

La mise au point d'un plan de ville et de ses faubourgs, est un travail de très longue haleine et que l'avenir seul peut mener à bien, lorsque par avance on aura à déterminer, à la suite d'une étude approfondie, le plan général de la cité agrandie.

Mais que d'erreurs sont commises journellement dans l'emplacement choisi et la construction des édifices les plus importants, qui montrent à quel point il est nécessaire de reviser nos programmes, nos plans, et surtout nos méthodes surannées de construire.

Il est certain que des erreurs monumentales, c'est bien le mot qui convient, sont faites à chaque instant dans nos villes modernes.

L'argent gaspillé dans des monuments énormes qui ne répondent pas aux besoins qu'ils doivent satisfaire, est un des scandales modernes de l'aménagement des villes. Il me serait aisé d'en citer un grand nombre de cas.

Je ne prendrai qu'un exemple. Un monument pris dans une catégorie de première importance et très moderne: Une gare principale de chemin de fer.

Qui ne connaît la ville d'Anvers et les parties si attachantes de la vieille cité flamande. On sait à quel point, même lorsqu'une municipalité veut faire les efforts nécessaires, il lui est difficile d'améliorer, tant au point de vue de l'hygiène qu'au point de vue esthétique, la ville qu'elle administre.

La nouvelle gare de chemin de fer bien connue est un monument gigantesque qui a coûté une somme de plus de 50 millions de francs ($10,000,000).

Lorsque l'on réfléchit à ce qu'est une gare de chemin de fer et à quels besoins précis elle répond, on est stupéfait de constater l'énormité de l'erreur commise à Anvers. La gare d'Anvers, munie des derniers perfectionnements de trafic, au lieu d'être un édifice raisonnable que l'on serait en droit d'attendre d'un monument si récent, n'est en réalité que le " palais de la fumée," ainsi que nous l'avons appelée avec un réalisme qui convient. Ses arches monstrueuses qui ne répondent à aucune nécessité, si ce n'est à la fantaisie de calculs d'ingénieurs, sont inexcusables. Au lieu d'avoir dépensé une somme aussi colossale à faire un monument, en définitive déplorable—je passe sous silence le caractère particulier de son architecture qui ne répond aucunement au bon goût traditionnel des Flandres—et que l'on songe à ce qu'une ville telle qu'Anvers a de sommes à dépenser rien que pour s'assainir ou s'organiser complètement, on reste confondu de la légèreté avec laquelle sont décidés et entrepris les plus grands travaux de nos jours.

Que pour la gare de chemin de fer d'une ville importante on édifie une façade digne d'elle, qui corresponde aux services généraux et aux entrées du public, c'est bien. Mais que pour mettre à couvert les trains qui se composent en définitive de voitures et de locomotives à l'échelle humaine, on monte des voûtes géantes, imitation grotesque des nefs des cathédrales, à la place de simples quais couverts par des auvents, c'est trop.

Aucun raisonnement, aucune beauté esthétique, ne sauraient excuser de pareilles erreurs, si ce n'est le plaisir de gaspiller les ressources de l'Etat et celles des communes. Il est temps que des procédés indignes de notre civilisation moderne soient énergiquement condamnés.

Ces erreurs dans la construction d'édifices aussi importants ont naturellement une répercussion immédiate sur l'administration intérieure d'une cité. Il est incontestable que lorsque des sommes aussi considérables ont été mal utilisées, il n'est possible avant longtemps de songer à améliorer l'hygiène et la beauté de cette ville.

Comment définir en quoi consiste la beauté d'une ville?

La beauté d'une ville est faite avant tout de la beauté de ses grandes lignes de circulation.

Sur ce point il faut reconnaître que jusque dans les plus belles villes que notre pensée puisse évoquer, nous n'avons que des fragments de cette beauté. Aucuns plans raisonnés, s'étendant aux limites possibles du développement d'une cité, n'a encore été entrepris.

Comment voulez-vous que dans ces conditions il soit possible de créer des monuments qui soient comme enchâssés dans un ensemble proportionné et harmonieux de lignes? On attaque pour se couvrir les travaux de l'achitecte! Certes, il a souvent oublié de se pénétrer des lignes environnantes lorsqu'il a arrêté les lignes capitales de son monument.

Ceci me rappelle une curieuse erreur faite à New York et que je signalai, il y a deux ans, aux Américains, par l'un des organes les plus importants de leur presse, The New York American.

La bibliothèque principale de la ville de New York, monument dont le coût est de 35 millions de francs, (7,000,000) fut tout simplement mal plantée dans le très beau terrain qui lui était consacré. Sa façade principale donne sur la Cinquième Avenue, l'avenue du grand luxe de l'architecture américaine, sur laquelle s'élèvent tant de monuments intéressants, dont quelques-uns même remarquables. Le terrain vaste, qui avait coûté une somme considérable, permettait l'établissement d'un grand square au devant, qui réserverait par derrière un vaste espace suffisant pour les agrandissements futurs et pour les dépôts de livres. Au lieu de reculer l'édifice et de placer ce square comme cadre tout désigné de sa façade monumentale sur la Cinquième Avenue, on a placé le cadre par derrière sur une avenue quelconque.

A peine signalée au grand journal de New York, cette erreur fut immédiatement relevée de tous côtés comme monumentale et malheureusement irréparable. Si l'on avait songé, en traçant ce programme, à la valeur qu'acquièrent les lignes générales d'un grand monument par le recul proportionné de sa façade principale, l'erreur n'aurait pas été commise. Il fallait y réfléchir pendant cinq minutes seulement. Il est vrai que les Américains, dont l'audace ne recule devant rien, décideront peut-être un jour de glisser sur roulettes leur bibliothèque pour la replacer en arrière!

La beauté d'une ville, comme sa salubrité, est également et peut être principalement influencée par la direction et l'orientation, par rapport aux rayons solaires, données à ses principales voies et à ses édifices.

Il est en effet inconcevable, lorsque, l'on examine de près la contexture d'une grande ville moderne, de constater à quel point on a oublié l'élément principal de la beauté des choses qui est dans leur éclairage.

Nous introduisons ici, peut être pour la première fois dans le débat, l'argumentation vraiment scientifique et rationnelle, sur laquelle repose toute la beauté des cités. Personne ne contestera, en effet, sans y avoir cependant jamais bien réfléchi, que la beauté des édifices est dans la manière dont la lumière du soleil éclaire, certaines parties ou projette des ombres sur d'autres.

Dans aucune des grandes périodes de l'histoire de l'art qui a fait éclore, depuis les civilisations les plus reculées de l'Asie ou de l'Afrique, les bâtiments les plus incomparables, on a oublié cette loi de l'orientation des grandes façades par rapport à la direction des rayons du soleil.

Quelles sont les villes de nos jours où l'on ne puisse trouver, comme à plaisir, des bâtiments considérables, ayant leurs plus belles façades plongées dans l'ombre ou à peine éclairées par des rayons frisants. Je crois que presqu'aucune des grandes villes du monde n'est exempte de ce grave reproche. C'est là peut-être la raison cachée de ces critiques si justifiées dont la ville moderne est à juste titre l'objet, mais dont on n'a pas su expliquer la véritable cause.

Le soleil, de plus, est reconnu par la science moderne—et ceci est capital—comme ayant une action souveraine sur la vie de l'individu, par sa puissance à la fois régénératrice de l'organisme humain et microbicide de premier ordre.

S'il est par conséquent véritable créateur de la santé, il ne faut pas oublier qu'il est également l'artiste par excellence qui mettra en valeur tous nos efforts pour créer la beauté plastique, dans ce qu'elle peut avoir de plus parfait.

Les monuments, dans les siècles passés, qui ont été profondément pensés at réfléchis avant que d'être exécutés, sont restés comme les types les plus remarquables du génie humain.

Voyez à cet égard, à Paris, la Place de la Concorde, l'ancienne Place Louis XV, qui fut, pendant un temps de bouleversement, la Place de la Révolution. Ses monuments sont admirablement orientés et leur éclairage savamment étudié en fait ressortir la grande noblesse de lignes; pas une erreur n'a été commise à cet égard, aussi leur effet a été universellement reconnu dans le monde comme voisin de la perfection. Lorsque l'on veut citer un exemple d'un effet monumental parfait, il faut toujours citer la Place de la Concorde.

On ne saurait donc assez méditer la grande loi de l'éclairage des monuments, qui se lie si intimement à leur beauté.

PRESENT STATUS OF VENTILATION.

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Ventilation, until recently secure in its position before the public, may now be said to be without definite or satisfactory status. Present standards are attacked and declared unscientific, the methods of ventilating engineers are condemned, and by some, artificial ventilation of schools, hospitals, and similar buildings is said to be entirely unnecessary.

It may be that not all of the principles of methods of ventilation accepted in the past or at the present time are correct, but if the best of them are in error the fact has not been scientifically demonstrated nor have better methods been exemplified.

It may be successfully maintained that ventilation as now practiced has accomplished much and should be continued until better methods are developed and proved to be correct.[1] Without a doubt lack of ventilation and inefficient ventilation result in a constant loss of human life and of actual money which, if correctly computed, would be appalling. This is adequate justification for the greatest urgency in carrying on investigations and tests and for such meetings as the one of this afternoon.

Much doubt and misapprehension regarding the worth of ventilation is being aroused by statements which are being made derogatory to ventilation, these statements being based upon lack of investigation and unscientific or incorrect data. They are doing incalculable injury to the cause of ventilation and to the best interests of mankind.

By many investigators the ventilation problem is approached as though it had but a single element of importance as, for instance, air volume, air quality, temperature, humidity, or air movement. By others two or three of these elements are viewed as essential, while by still others the problem of ventilation is viewed as a problem having several sides of perhaps equal or at least great importance and other sides of less importance. To the author the latter view seems the correct one.

These problems may be grouped for study into two classes, namely, air conditioning and ventilating methods.

In the first division would be included:

(*a*) Chemical composition of air; with special reference to oxygen, ozone, carbon dioxide; and investigations of those elements in the air to which but little thought is now given.

(*b*) Organic matter; that is, that due to exhalations and body excretions.

(*c*) Dust.

(*d*) Humidity.

(*e*) Temperature; optimum; effect of high, low, and varying.

(*f*) Air volume; for different classes of people, different surroundings, as effected by different systems of ventilation, different chemical and physical qualities or different degrees of diffusion.

(*g*) Air movements; still, moving (below the point of sensible drafts), drafts, breezes.

(*h*) Heating of air; is it, whether containing or free from dust, injured by heating? Relative effects of high and low temperature heating surfaces.

(*i*) Cooling.

(*j*) Recirculation.

As incidental questions worthy of serious study there might be included:

(*k*) Relation of ventilation to conditions of rest, sleep, normal activity, and violent exercise and ventilation as affected by age, sex, and climate.

(*l*) Methods of determining the effect of ventilation and its elements upon the individual and upon masses of people.

(*m*) Natural versus artificial ventilation.

(*n*) Efficiency of installation and operation.

It would seem necessary that the air should be properly conditioned before considering the method of its use, just as a surgeon looks to the condition of his instruments before undertaking his task. Not that air conditioning is necessarily the most important question involved, but good ventilation can be possible only when good air is the basis thereof, and no manipulation of air volume, movement, or temperature of foul or improperly conditioned air may be made a substitute for good air. It is admitted that poor aerial surroundings may be improved by a stirring of the poor air, but this does not constitute good ventilation. As stated by Prof. Affleck:[2]

> As far as experimental conditions are concerned, the chemical composition of the expired air does not produce an injurious effect upon the human system, but the writer has yet to learn of extended observations which prove that continuous living in such invitiated air does not impair health.

The designing engineer has in the past paid too little attention to the quality of the air used for ventilation or to its source.

(*a*) Referring to the chemical composition of the air, oxygen is generally considered the most important element. Normal air contains approximately 21 per cent of oxygen; exhaled it still contains about 16 per cent, the 5 per cent difference in oxygen having been replaced by carbon dioxide, water vapor, and tissue excretions. It is stated by the physician and the biologist that no good is accomplished by increasing the proportion of oxygen beyond the 21 per cent, even in cases of pneumonia, and that we could continue to exist indefinitely in air containing 16 per cent of oxygen, but no assertion may be made that air containing 21 per cent of oxygen and free from the elements with which it is ladened upon exhalation is not better than the air containing 16 per cent of oxygen and 5 per cent of injected undesirables.

Carbon dioxide, once considered a poison, is now considered negligible so far as its effect upon health is concerned, but we may not neglect its value as a means of determining air quality, for, although not necessarily harmful in itself, it is a fact that large proportions of carbon dioxide usually indicate decreased proportions of oxygen or the presence of carbon dioxide produced by the distillation of dust or otherwise.

Ozone, only recently linked with the question of ventilation, is worthy of serious consideration. It has proved an efficient ally to the physicians in cases of pneumonia and other diseases, and its value as a sterilizing and an oxidizing agent is generally recognized. Practically no use is now being made by engineers of ozone as an adjunct to ventilation, although a limited amount of experimentation is under way to determine its worth. The cost of installing and operating ozone machines is relatively so small, in comparison with the cost of installing or operating the ventilation plant (probably not over 2 to 4 per cent), that, if its efficacy is demonstrated, cost should prove no obstacle. Its use in connection with the ventilation of the English Parliament buildings is said to have been advocated by Dr. Leonard Hill. That it is striking the popular imagination is evidenced by its use in some of our theaters and by the many small ozonizing devices coming into the market. However, this use is without scientific basis or measure. Slightly noticeable at times in the country or on the sea, it is practically lacking from the air of the city, due probably to its absorption in the process of oxidization of wastes of the city streets and to the presence of factories and power plants.

It is found in the proportion of about one part to a million in country and sea air, while it is practically missing in the air of the city. May it not be possible to improve the air of our habitations in the city by a restoration of that amount of ozone found in country or sea air if it may be done by means of apparatus which will not also produce nitrous oxides or other harmful products?

Dr. G. Lennox Curtis, who has experimented largely in this field, asks: "If ozone is the active principle of oxygen and the atmosphere of cities contains only a small percentage of it, why not supply it by means of the electric coil and ozone generator?"

It is possible that there are other important constituents of the air of which but little is known, as, for instance, argon.

(*b*) The problem of organic matter in the air of an occupied apartment is still in debate. Brown-Sequard and others proved to their satisfaction that such matter exists. Haldane, Smith, Lehman, and others proved to the satisfaction of themselves and others that such was not the case. Prof. Rosenau, as the result of recent experiments, concludes that there is justification for the belief in the existence of organic matter, specific in its nature, in expired air. Analysis of his experiments may lead the physician and the biologist to question the correctness of his conclusions, but so direct a bearing has this question on the all-important question of air renewal that the earliest possible determination of the problem is urged.

(*c*) The dust problem, as it relates to ventilation, is too lightly considered. It is more than an annoyance, for it involves physical, biological, and chemical phases. Breathed into the respiratory tract it may cause not only annoyance, but irritation or even abrasions which, in the opinion of many, increase the liability to communication of disease. The germ-bearing possibilities of dust are strongly urged by some authorities and denied by others, the same situation existing in the matter of communicability of disease through the means of germ-laden dust and air.

Tests by Profs. V. Esmarch and Nussbaum are quoted as evidence of a chemical change of the air due to the decomposition of organic matter when coming into contact with heating surfaces of high temperature, ammonia being found in noticeable quantities by both experimentors, while others have maintained that carbon monoxide is produced. Objectionable odors are said to be due to this cause, and the air is said to be robbed of ozone, which has been utilized in the process of oxidation.

Mr. Conrad Meier, an eminent ventilating engineer, as the result of study and observation, in a paper on the subject asserts that the dust problem is the most important one in the general problem of ventilation—far more important than the question of humidity. Indeed, he states that most of the complaints charged to extremely dry air are due to the effect of dust.

Relatively few ventilating systems include air filters, and the majority of the filters used are of the cloth variety, the cloth often being too small in area, of small merit as a filtering medium, and mounted on poorly constructed and leaky frames. In a fan system of ventilation the velocity of the air through the cloth should not exceed 40 feet per minute. The use of the air washing filter, which is much superior, has been limited, because, like many other desirable adjuncts to a complete ventilating system, it is too often proscribed on the ground of cost, although the average cost of the cloth filter is about 2 to 4 per cent, and that of the air washer but 4 to 7 per cent, of the cost of the heating and ventilating system.

(*d*) Humidity is another much-debated question. There are those, like Mr. Meier and Prof. Woodbridge, who decry the importance of artificial humidification, or who see no ill effects in breathing dry air, placing no faith in what seems to be justifiably said to be the ill effects of dry air. On the other hand, Dr. Henry Mitchell Smith, Prof. Hough, Dr. Wilson, and others maintain that excessively dry air results in the enlargement of gland tissues and the thickening of the membrane of the respiratory tract; the production of feverish and parched tongue, lips, and skin; the causing of the eyes to redden and smart, the ears to become dried, and the aggravation of catarrhal conditions, the latter extending even into the Eustachian tubes. Headaches are said to result, the vitality to be lessened, and the dry air is regarded as an excitant, causing sleeplessness and irritability. In a plant coming under the notice of the author, just these complaints are made whenever, in cold weather, the humidifying system becomes inoperative.

Conversely, the authorities last named above assert that moist air feels balmy, and has a soothing or depressive effect which tends to produce restfulness and sleep.

The effects upon our health and comfort of moisture in the air, as it acts through the respiratory tract and on the outer surface of the body, should be determined with more exactness.

As to the desirable degree of humidity, there seems to be little agreement among engineers or physicians, but 30 per cent minimum and 80 per cent maximum are the extreme limits mentioned. In artificial humidification, it is the practice of designing engineers to provide for a maximum of 50 per cent, this being regarded as sufficient to maintain healthful conditions, while 35 per cent is used as a minimum in extremely cold weather, to provide against condensation on outside walls and on windows and because it is believed that no harm will result at this minimum. It may be that this lower range is too low, but it has yet to be proved, and this is not below a condition sometimes found in outside air.

The humidity within our homes, schools, hospitals, offices, stores, and factories will frequently be found to be below 20 per cent, and sometimes as low as 12 per cent, much less than on the driest desert known. Opening of the windows will not remedy this condition without lowering the temperature, for the warming by the radiators of the air thus admitted increases its capacity for moisture; that is, reduces its relative humidity.

That humidifying devices are not more used is less the fault of designing engineers than of owners and architects, who will not authorize the necessary expenditure. The cost of such devices is not great. Evaporating pans with steam coils and automatic humidity regulation will usually cost less than $400 for 15,000 cubic feet of air per minute, or from about 3 to 5 per cent of the cost of the heating and ventilating system. A humidifying device with automatic regulation applied to the air washer involves no greater cost, and this is the better arrangement, as it provides for dust elimination also.

The cost of operating the humidifying system may not be neglected. It requires approximately four times as much coal to evaporate the water necessary to raise the inside relative humidity to 50 per cent on a zero day as may be saved by lowering the room temperature from 70° to 60°. But there is no question in the mind of the author that artificial humidification is most important and worth more than its cost.

(*e*) Temperature and humidity are urged as the most important elements of ventilation, especially by Winslow, Benedict, Evans, Crowder, and others. The author believes that they are very important, but believes also that their relative importance is too greatly magnified, in view of the limited data of conclusive nature available.

Seventy degrees was long accepted as the desirable temperature in this country, although 68° is now the standard generally used by engineers. In England 60° is generally adopted, although there is said to be a growing tendency toward a higher temperature there. Experiments are being conducted in Boston and New York schools and elsewhere to determine the possibility of reducing the temperature to 65°, or even 60°, and to determine the relation of humidity and temperature as they affect the pupils.

As is well known, excessively high temperatures, especially when associated with high humidity, place a severe tax upon the temperature-regulating system of the body. It is generally agreed that the critical point of comfort is 72° wet-bulb temperature, a fact which is the basis of much of the argument for replacing the dry bulb with the wet-bulb thermometer, the wisdom of which is disputed by Mr. J. I. Lyle.

It is urged by Dr. Gulick, Dr. Thompson, and others that a varying temperature is desirable. That low temperatures have a therapeutic value is common knowledge, and we are all subject to, and doubtless helped by, nature's varying temperature. But during periods of sedentary occupations with the usual clothing, a uniform temperature is required. A combination of periods of uniform temperature during periods of quiet, with a lowering of temperature and a "flushing out" of the room during short periods of exercise, is unquestionably good, even if not scientifically demonstrated. The manipulation of the ventilating system will vary the temperature, or the windows may be better used for this purpose.

The temperature of a densely occupied apartment is directly affected by the occupants thereof, method of illumination, adjoining buildings, and exposure. For the proper regulation of room temperature the heating and ventilation should be the functions of separate portions of the apparatus; that is, direct radiators should be used for heating to the extent of balancing the heat losses through exterior walls, windows, and outside doors, and indirect radiation should be used for heating the air used for ventilation. The units of direct radiation should be small and generally distributed to prevent concentration of heat and to promote quick heating and cooling of radiators.

With the problems of air conditioning solved, the question of methods of ventilation, air standards, and so forth, would be greatly simplified.

The standards now in use by engineers are arbitrary, and are too little modified in practice to cover the varying conditions above mentioned, being based upon the maintenance of certain CO_2 standards. The air quantities generally used in practice are 30 cubic feet per minute per occupant in schools; 15 to 30 in theaters, churches, auditoriums, factories, and mercantile establishments; 60 to 100 in hospitals and dwellings; and 100 to 200 in contagious hospitals.

These quantities have been used in connection with ventilating systems operating on the dilution principle; that is, the air is admitted above the breathing line and exhausted at the floor. There is a growing agitation in favor of the displacement method of ventilation, in which the air is admitted near or through the floor and exhausted at the ceiling, on the theory that the natural course of the air about the body and that exhaled is upward, because of its higher temperature and its greater vapor content. The author believes this theory to be far from proven, but of sufficient importance to warrant careful study. If the theory be correct, it may have a most important bearing upon the quantity of air required for ventilation.

The method of upward ventilation seems to be gaining adherents, but in most cases they are rabidly partisan, and they neglect what may be governing conditions, such as details of building construction, possibility of difficulty in the proper diffusion of the air, or the much more important matter of temperature as affected by the heat from the crowd and the lights.

Frequently the practicing engineer finds the heating effect of the occupants and the lights of an auditorium sufficient to warm 30 cubic feet of air per minute per occupant 10° to 12° and even 15°. In such a case, if it is desired to maintain a temperature of 65° in the room, the air must be admitted at 50° to 55° of temperature. This may not be done through the floor without endangering the comfort and even the health of the occupants, for, to secure proper distribution, the air must be admitted in the immediate vicinity of the occupant; that is, under the seats. When admitting the air through the ceiling and exhausting it through the floor, the air gradually takes up this heat increment and passes at a comfortable temperature over the body. Incidentally, it strikes the head while cool and passes over the foot warmer, which is physiologically better than the reverse course. With 30 cubic feet, the downward method has been found satisfactory. Any attempt to lessen the volume of air with the use of the upward method in such cases will involve further difficulty in the matter of temperatures. A system which may be reversed, running downward in cold weather and upward in hot weather (to carry off the heat), is successfully used.

While the above remarks apply especially to auditorium ventilation, this same difficulty may be encountered to a lesser degree in attempting the upward method of ventilation of schoolrooms, and this condition will be aggravated in the case of rooms subjected to the heating effects of the sun. The sun's heat must be counterbalanced by the air used for ventilation, the air being brought into the room enough below the desired room temperature to absorb the heat given off by the occupants and the excess heat communicated to the room by the sun.

It is the author's opinion that diffusion of air introduced and exhausted for ventilation has been given altogether too little consideration.

It is a customary practice among engineers to use one inlet and one outlet to ventilate a schoolroom or a court room, and too often this is applied to a hospital ward, and to other kinds of ventilation work. It is very difficult, and often impossible, under these conditions, to secure an even diffusion of air in a room as large as a standard schoolroom. Thus stagnant areas may occur, and the ventilating system is then condemned. In the design of the ventilating system for a new building, the location of ventilating flues is always troublesome. The architect often finds it difficult, or is sometimes unwilling, to provide sufficient or suitably located spaces, or money is not made available for their construction. Manifestly, a change from the single inlet and single exhaust to multiple openings, properly proportioned and placed, through which the same amount of air moves, will assure diffusion and efficiency, prevent stagnant areas, and thus have a direct bearing on the volume of air required.

Air quality also must possess a direct relation to air volumes, for it is inconceivable that a certain amount of poor or improperly conditioned air will do the same ventilating work as the same amount of air of the best quality.

(*g*) Air movement, as emphasized by Hill and others, as a relief for too hot or too humid conditions, is a welcome adjunct to ventilation, but as a substitute it is not to be considered. It doubtless accomplishes a desirable end in removing the body envelope of hot moist air and the exhaled air from the breathing zone, but the air thus removed should be replaced with pure air of a proper temperature and humidity. The air movement produced by a ventilating system should and will accomplish this without drafts.

Drafts, which would include air velocities from the point where they become sensible to the point of a breeze, are objectionable, but air movement below the limit of a sensible current is essential, otherwise the air becomes stagnant, and there is no removal of the heat and moisture of the body envelope. Outdoor breezes, which bathe the entire body (assuming that proper clothing is worn) are healthful, but breezes never will be acceptable indoors during the winter.

(*h*) Dr. Thompson and others state that air passed through the ventilating system is robbed of its " freshness." It is possible that such observations are due to the generation of ammonia, and, possibly, carbon monoxide, from dust in the air coming into contact with the heating surfaces of excessively high temperatures. With the dust eliminated, it is not believed that air is robbed of anything when brought into contact with heating surfaces of moderate temperatures; that is, not in excess of 215°, the air not to be heated in excess of 100°, preferably not higher than 80° to 90°. Indeed, with dust eliminated, there is no scientific basis for the assertion that the air is robbed in any way by being brought into contact with surfaces at a higher temperature. Chemical and physiological tests along this line are desirable.

In the belief that the temperature to which the air should be heated should be as low as possible, the majority of engineers now use direct radiators in the rooms to overcome heat losses through walls and windows, while heating the air supplied by the ventilating system to a temperature but little in excess of the room temperature, the excess being designed to make up for loss of temperature in transmission. The "blast" system of heating and ventilating, in which all of the heating was done by means of blast coils which heated the air to 125° or even 150°, is now but little used in schools, hospitals, or similar buildings.

(*i*) In the field of air cooling, but relatively little has been done, largely because of the cost of installing and operating the apparatus, for a positive method of cooling involves the use of refrigerating apparatus.

It is suggested that the heating or ventilating system may in part be used for this purpose, and that there is no more reason why we should heat our apartments in winter than cool them in summer. A very limited amount of creditable work has been done in the cooling of banking rooms and hospital wards, in which the same fans and fan coils are used for heating and cooling, steam being used in the coils in winter, and brine used in summer. Usually a cooling effect of 10° in extremely hot weather is the maximum desired.

In one case the removal of a cooling system which cost a very large sum is contemplated, not because the desired temperature and relative humidity were not maintained with any outside weather conditions, but because the effect of the cooled wards was not believed to be of as much value clinically as the free use of the sea air through open windows. During the operation of the cooling plant observations were made on the patients and on the nurses, records being taken every 15 minutes in the case of the nurses from whom complaints of headaches were frequent.

It may be that the real cause of complaint was the fact that a 70° temperature and 50 per cent relative humidity were maintained at all times, and that the difference between inside and outside conditions was too great for the comfort of the nurses subjected to both natural and artificial conditions. Also the hospital was unusually located so that it received sea breezes at all times.

The cost of installing the cooling plant is large. In a recent case involving the supplying of 20,000 cubic feet of air per minute (not a large installation) the increase in size of the refrigerating plant involved $6,000 of additional expense. Had a plant been installed especially for this purpose, the cost would have been double the amount.

It is difficult to make a definite statement regarding the cost of operating an air-cooling plant. If exhaust steam, otherwise unused, is available, the cost of fuel may be eliminated by the use of an absorption refrigerating plant. If the water required for cooling in the refrigerating plant may be used in the boilers and plumbing system, another large expense is also eliminated. The cost of service, the remaining important item of expense, depends upon the size of the power plant of which this is a part. The other incidental expenses are small.

If exhaust steam is not available or if the water used by the refrigerating plant for cooling may not be used as suggested, the cost of operating the air-cooling plant becomes serious. In such a case it may be generally stated that the cost of cooling a building 10° is approximately equal to the cost of warming it to 70° in zero weather.

(*j*) It is only recently that the idea has been conceived of recirculating the air used for ventilation. At the International Y. M. C. A. College, Springfield, Mass., some most interesting experiments have been made along this line by Dr. McCurdy and Prof. Affleck.[3]

It was found that so long as the same air (except as affected by natural leakage) was used and was passed through the air washer in operation, the conditions in the room were entirely satisfactory to the men exercising in the room, but when the washer was not in operation conditions immediately became objectionable and odors were noticeable. The effect upon the men of the recirculated air was no different, so far as could be felt or observed, from the effect of the air when taken directly from outside. In these same tests interesting data were obtained regarding the effect of varying temperatures and humidities. Additional tests and experiments along this line are to be made during the coming winter.

(*k*) It is difficult to say how much attention is given by engineers to the varying demands on ventilation as affected by conditions of occupancy, such as rest, sleep, normal activity, mild or violent exercise; to the questions of age, sex, conditions of health, cleanliness of occupants, or to the effect of the illuminant used. Possibly the data is more advanced than the practice, but additional data for these various conditions is desirable, both as to heat and moisture elimination and air quantities required.

(*l*) So far as is known to the author, there is no agreement as to a satisfactory method of determining the effect of ventilation or the effect of its lack. The psychological element makes it necessary that the subjects of the experiment should not be acquainted with the fact that they are under experiment except under unusual circumstances. There are so many variables in ventilation that it is necessary to make long continued experiments under each condition upon a large number of subjects with carefully prepared records covering all the necessary physical details, such as health, surroundings, and general progress of the subjects; also records of the temperatures, humidity, and air quality and quantities involved.

(*m*) A great furore is being made by the advocates of natural (window) ventilation, especially for schools and hospitals, the elimination of artificial ventilation for such buildings being urged. It may not be inappropriate to refer to the appeal made to the American Society of Heating and Ventilating Engineers, in January of this year, that it should undertake a movement to bring about the elimination of artificial ventilation from school buildings. It seems to be forgotten by the advocate of natural ventilation that artificial ventilation of schools was developed more than 40 years ago largely because of the failure of systems of natural ventilation.

There would seem to be a serious lack of perception, in this crusade, on the part of those who class together schools and hospitals, for the conditions in the two classes of buildings are radically different. The usual hospital ward has windows on two or three sides, well exposed to the wind; the patients are under the special care of nurses, and the space per capita is large. In the case of the modern school the unilateral system of lighting prevails, so that there are openings upon but one side of the room, the pupils are variously clothed, and the space per capita is less than one-fourth of that in the hospital. The wind can serve the rooms of but one side, or never more than two sides, of the school building and the same side in not always served by the wind. What do the advocates of exclusively natural ventilation propose for the rooms upon the remaining two or three sides of the building?

There is no question that natural ventilation should be used just as often and just so far as it can be employed without endangering the health and comfort of the room's occupants. The ventilating system, as now designed by the best engineers, is not "unbalanced" by the opening of windows and doors, so that conflict between natural and artificial systems is avoided.

For all densely occupied buildings, such as schools, most hospitals, libraries, churches, theaters, auditoriums, mercantile establishments, factories, and the like, natural ventilation is insufficient during much of the heating season, and a system of artificial ventilation is essential to the comfort, health, and efficiency of the occupants of the building. Also, the degree of efficiency with which the building serves the purpose for which it was built is directly increased by the ventilating system. Some of the buildings of the classes mentioned manifestly require artificial ventilation whenever occupied, the others during inclement weather and, when, as is frequently the case, the lack of a breeze brings about the most serious failure of natural ventilation. Also, artificial ventilation is necessary for those sides of a building not exposed to the breeze, for the season of the year when the windows may not in safety be opened, especially in schools, and for night service where ventilation is required during the night in cold weather.

How air filtration, humidification, and the prevention of the so-called robbing of the air of its freshness by bringing it into contact with the direct radiators in the room, are to be accomplished is not explained by the advocates of natural ventilation, nor have they produced medical, scientific, or other practical data substantiating their position.

There is a growing conviction that, when the problems of air conditioning and the proper use of the air are mastered, the artificial ventilating system will readily demonstrate its usefulness and its superiority over natural ventilation.

(*n*) To the practicing engineer the following reasons appear primarily responsible for many of the alleged failures of ventilating systems already installed, and for much of the resultant criticism: Lack of skill in designing; a penurious policy on the part of the owner in restricting the funds available for the purpose; lack of skill on the part of the operating engineer, and the purpose of the owner to reduce the cost of fuel, electric current, and labor, regardless of its effect in limiting the efficiency of the ventilating system. So long as the owner will decline to pay the extra cost of expert services for the design of the ventilating equipment, leaving what is essentially an engineering matter in the hands of the architects or contractors; so long as he will insist on more space, more marble, or more gargoyles, for the same appropriation, in preference to giving adequate heart and lungs to the building; so long as he will employ cheap labor, failing to realize that this is the most expensive course in the end; and so long as he insists on reducing coal, electric, and labor bills at the expense of a limitation of the vitalizing air supply of the building, just so long may failures of ventilation systems be anticipated.

Where a school board too closely watches the coal pile, and taxes the operating and designing engineer for every pound of coal burned, it may not, with justice, hold the teachers responsible for poor results with the students. If installation and low fuel costs are preferred to ruddy cheeks, and bright, attentive, and retentive minds, air filters, humidifiers, and even the ventilation system may be dispensed with. The publicity which has been given to the critics, and their reference to "sterilized," "roasted," "canned," or "superheated" air, and air heated to 400° (which is impossible in a steam-heating system) could scarcely fail to promote a disinclination among owners to properly install or operate ventilating systems. A great campaign of education is needed to inform the public of the great value of the fully equipped and properly operated artificial ventilating system.

The solution of the problems of ventilation involves much painstaking study, investigation, and experimentation, the correlation of current experiments, and the cooperation of experimenters. It involves physiological and engineering questions, necessitating, for its fullest and quickest solution, the active cooperation of the medical and the engineering professions. A national ventilation commission, adequately financed, would be the most efficient instrument in bringing about these results. This commission should consist of doctors, physiologists, laboratory men, and designing engineers who are experimenting in this field. Its work would be similar to that of the national milk and other similar commissions. By cooperating with investigators, collating data, comparing results obtained in different cases, suggesting new tests and experiments, publishing information, and finally determining certain standards and methods for ventilation, a very great service would be performed for the people of this country. The comfort and welfare of humanity, which are so vitally at stake, should be sufficient to command to energetic action in the solution of these problems.

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[1] Ventilation and public health: Annals of American Academy of Political and Social Science, March, 1911.

[2] The ventilation of gymnasia: American Physical Education Review, April, 1912.

[3] American Physical Educational Review, June, 1912.

THE NEW ART OF VENTILATION: SOME PRINCIPLES WHICH FOLLOW FROM RECENT PHYSIOLOGICAL RESEARCH.

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The art of ventilation was born too soon. Water purification began to be important only after it was learned what the real objects of the process were. The aims of sewage disposal and garbage disposal have always been more or less clear, although emphasis has shifted somewhat as to the relative weight of sanitary and esthetic motives. Ventilation, however, became a vigorous practical art long before there was any real knowledge as to the effects upon the body of the air of confined spaces; that is, before there was any sound conception of what the objects of ventilation were. Tomes were written upon the subject, based on wholly erroneous conceptions as to the dangers from expired air.

First, carbon dioxid was treated as, in itself, a poisonous and dangerous substance, and the chief cause of the sensations experienced in a crowded room. In so recent and in many respects so excellent a book as Hoffman and Raber's Handbook for Heating and Ventilating Engineers (1910) we read that carbon dioxid "is constantly being diffused throughout the air of the room, thus rendering it unfit for use. If this carbonic-acid gas could be disassociated from the rest of the air and expelled from the room without taking large quantities of otherwise pure air with it, the problem of the heating engineer would be simplified, but this can not be done." The effect of carbon dioxid, however, could easily be tested, and was long ago proved to be nil in any concentrations which could occur under the most extreme conditions of normal occupancy.

Then the mystically minded turned to the organic matter in the air, and aided by Brown-Séquard, whose brilliant but loose experimentation gave currency to so many scientific fallacies, the conception of a subtle and mysterious poisonous, morbific matter, or crowd poison, was evolved. This theory was more intangible and therefore less easy to disprove.

Gradually, however, it was shown by the work of Flügge, in Germany, of Haldane and Hill in England, and of Benedict in the United States that the chemical explanation of the harmfulness of the air of confined spaces was wholly without foundation. When men are shut up in calorimeters all the effects of vitiated air can be duplicated by the combined effect of two simple physical factors—heat and moisture; while, vice versa, if the atmosphere be kept cool, all the effects of crowd poison disappear, even when over 1 per cent of carbon dioxid be present with all its accompanying morbific matter. The lassitude, depression, headache, dizziness, and tendency to nausea, which the susceptible experience in crowded rooms, were all produced at the Hygienic Institute in Breslau by heat and moisture alone. They were not relieved by breathing pure air through a tube. They were relieved by cooling or drying or agitating the air without changing its chemical composition.

The phenomena of increased metabolism and increased blood pressure, described by Dr. Gilman Thompson,[1] as following a change from indoor to outdoor air, are familiar physiological results of lowered temperature. In the same paper Dr. Thompson contends that "our present physical means of determining the properties of the air completely fail in recording its most subtle, yet most important, property, namely, that which everyone recognizes for himself, the quality called 'freshness.' Superheated air conveyed through long metal conduits is 'canned' air or 'roasted' air, and has no more 'uplift' for the invalid or growing child than a meal of canned corn has for the dyspeptic." The well-known doctrine of parsimony in logic, however, forbids us to make two assumptions when one will serve. Anyone who will consult the work of Flügge's pupils, and of Haldane, to which full references are made in an admirable review by Dr. T. R. Crowder, or the more recent work of Leonard Hill, will see that every known physiological effect of "fresh air" has been shown to be due to its physical properties. When new physiological effects are demonstrated to be due to "fresh air" and not to stale air with the same temperature and humidity it may be necessary to introduce new hypothetical qualities. It is quite clear at present, however, that the principal condition which makes the air of confined spaces uncomfortable and injurious, and really the only condition of which we have definite scientific knowledge, is excessive temperature and humidity. I am speaking now only of the effects of human occupancy, and am excluding, for the moment, the dusts and fumes produced by the combustion of illuminants and by various industrial processes.

The logical conclusion from this premise might at first seem to be that we need not ventilate at all, but might simply cut down heat so as to maintain a low temperature and let air changes take care of themselves. If we could deal only with human beings in a high state of cleanliness this might be the case, though even then air change would offer the most convenient method of keeping cool. Even in the tightly closed sleeping room of a farmhouse in winter ventilation is practically taking place on a considerable scale through the ceiling and walls and is actually serving to carry away the body heat. Furthermore, under actual working conditions we must deal with human bodies and human clothing as they are; that is, with bodies and clothing which give off considerable quantities of malodorous organic substances. We have no evidence that such odors are injurious to health, but they are offensive to those who enter occupied rooms and for esthetic reasons they should be removed. We must deal with illuminants which discharge carbon monoxid and other more or less poisonous substances and which may have considerable sanitary significance. We must deal in factories with dust and fumes which are highly dangerous and which must certainly be eliminated. Ventilation or air change is generally essential, but the quality of the air supplied is far more important than the quantity. Air conditioning to secure optimum conditions for the working of the living machine, not the removal of supposititious poisonous products, is the prime object of ventilation.

It is no wonder, since the ventilating engineer until within a year or two has not had those facts called to his attention, that he has often failed to produce the comfortable conditions at which he aimed. This is the first reason why artificial ventilation has frequently been a failure, but there are two others of almost equal importance. The lack of a proper theoretical basis is primarily the fault of the sanitarian. The second defect in very many ventilating systems comes home more directly to the designing engineer. It lies in faulty construction of ducts and faulty placing of inlets, so that a reasonably good distribution of the air forced into the system has not been attained. This has naturally not occurred in the work of the best ventilating engineers, but I think all who are familiar with the art will admit that the distinction between the competent and the incompetent has not been clearly drawn in this branch of the engineering profession and that a great deal of poor work has been foisted upon the public. A third reason for disappointment with systems of ventilation comes back to the authorities responsible for their operation. It is useless to design a good ventilating plant and place it in charge of an incompetent janitor. Yet this has been the rule rather than the exception so far as schools and other public buildings are concerned.

With all these adverse circumstances, it is small wonder that general dissatisfaction prevails in regard to the results of so-called "artificial ventilation." Hospitals and schools have installed elaborate and costly systems, and their occupants, without knowing just what was wrong, have found that they were uncomfortable, hot, stuffy, bad smelling, and have become disgusted with the whole affair.

There is a strong movement to-day in many quarters to cast aside entirely all ventilation by fans, and to rely on open windows alone. Hospitals in New York and elsewhere are being built without ventilating systems, and vigorous arguments are presented for school buildings built on the same plan. It is useless to ignore this growing body of public opinion, or to meet it with arguments as to the theoretical superiority of scientific air conditioning over the casual conditions which we owe to the beneficence of nature. It must be answered, not by words but by deeds; by the design and operation of artificial ventilation systems which shall actually produce atmospheric conditions shown by physical tests and by the sensations of occupants to be more suitable for the human being than are those provided by nature. This means a new art of ventilation based, not on the pseudo-sanitation of 30 years ago, but on the accepted results of modern physiology. As a biologist, familiar with some aspects of the science of the human body, and as a sanitarian, called upon to study and report upon the adequacy of ventilating plans and the results of their operation, I want to venture the dangerous task of pointing out what I think must be some of the fundamental principles of this new art.

(1) *Good ventilation involves the lowering of the temperature of a room by cool air.*—The most essential point in ventilation, one which overshadows all others, is the removal of excess heat and moisture. It is clear, then, that any system which does not guard against overheating is bound to fail; and this is precisely where the ordinary system does fail. The usual plan, in a school or a factory, is to combine direct and indirect heating, and to supply fresh air at a temperature above that in the room. . The commonest arrangement of inlets and outlets is based on the assumption that air entering at the top will be cooled and will take its exit at the bottom. The incoming air is usually kept at 68° or 70°. When the heat loss through walls is very rapid, all may be well. As soon as the room temperature rises to 70°, however, trouble begins. The direct radiation shuts off at 68° or 70°, but the radiating surfaces remain hot. People and

sources of illumination continue to produce heat. The temperature mounts to 72°, 75°, and, in crowded rooms, to 80° or more. Anyone who has regulated a low-temperature incubator knows that it is quite as necessary to have some automatic means of cooling it when it grows too hot as to provide for heating it when it gets too cool. This is where the ordinary heating and ventilating system breaks down. It usually includes efficient methods of quickly supplying heat when the temperature falls, but no methods of quickly removing excess heat when the temperature rises. A system can be guarded against overheating only by supplying air which is considerably cooler than the room temperature to be maintained. With such a condition, when the temperature rises to the point at which thermostats are set, and direct radiation is shut off, the cool air may be relied upon to remove excess heat as fast as it is formed.

It will be noted that this principle of cool-air supply implies a separation, in part at least, of the processes of heating and of ventilation, such as Dr. W. A. Evans, of Chicago, has so ably urged. In cold weather a certain amount of the necessary heat may be supplied by heating the incoming air to 55° or 60°, or whatever temperature may be adopted. Supplementary direct heating will, however, almost always be necessary. I regard it as quite impossible to secure proper temperature regulation without two distinct and independent factors, namely, direct radiation for heating, and air for cooling. On the other hand, all this does not necessarily imply artificial ventilation so called. The supply of cool air necessary to remove excess heat may be supplied through windows or through pipes, and driven by gravity or by fans.

If once we face the fact that the prime test of a ventilation system is its ability to maintain a low temperature, we gain at once a wholly new basis for the calculation of ventilation constants. Instead of figuring our air supply on the amounts necessary to dilute a given volume of carbon dioxid, we can estimate it on a basis of heat removal. For example, according to Pettenkofer's classic figure, which is a very low one, an adult gives off 400 British thermal units per hour. Let us assume that this heat must be removed by air entering the room at 60° and leaving it at not above 70°. One British thermal unit raises the temperature of about 50 cubic feet of air by 1°, or the temperature of 5 cubic feet of air from 60° to 70°. Hence our average adult, producing 400 British thermal units, will require 2,000 cubic feet of air per hour at 60° to keep the surrounding temperature from rising. An ordinary gas burner produces 300 British thermal units per candlepower-hour; therefore each such burner requires 1,500 cubic feet of air per candlepower. These calculations of course ignore direct heat loss through walls and ceiling which, with a zero temperature outside, may carry off the heat produced by 50 or 100 people.

Ventilation provisions must, however, be based on the least rather than on the most favorable conditions. In crowded auditoria every bit of the 2,000 cubic feet of air is needed; and, in many industrial processes, where the heat produced by human beings and illuminants is reenforced by the friction of machinery, and the heat from solder pots, furnaces, mangles, pressing irons, and a host of other sources, even more will be required.

(2) *Heated air should be removed from above and fresh cool air admitted below.*—This second principle embodies another of the positions maintained by Dr. Evans and his associates on the Chicago Ventilation Commission. It follows as a necessary corollary from the first principle of cool-air supply. Almost all school-ventilation systems, many systems in factories, and some even in auditoria are constructed on the opposite principle, with inlets at the top and outlets at the bottom. Usually the outlets are placed just below the inlets on the assumption that the warm air, as it enters, will pass across the room, gradually become cooled, and falling, return along the floor. It is clear that the instant the room temperature rises above that of the incoming air, the system tends to work badly. As the cooler air enters, it is likely to drop and pass to the outlet without materially affecting the general air of the room. These things are almost too obvious to dwell upon, but they must be emphasized as long as people continue to wonder why schoolrooms become overheated when supplied with warm air from ceiling inlets, an arrangement designed to frustrate every possibility of rational air conditioning. If the incoming air is to heat the room and is to be cooled in passing through it, it is of course reasonable to introduce it from above. If it is of the same temperature as the room and driven solely by mechanical power, its point of entry is a matter which may be arranged as one pleases, according to local conditions. If, however, my first assumption is justified, if, in order to guard against overheating, it is essential that the incoming air should be below the temperature maintained in the room and should be warmed in its passage through it, upward ventilation is the only rational method.

(3) *Incoming cool air should be tempered*, unless the number of occupants in a room is small. The first two principles which have been stated do not necessarily presuppose "artificial" ventilation. We put them into practice whenever we open our bedroom windows at the top and at the bottom. The question whether outside air should be tempered or not, however, launches us at once into the controversy as to artificial versus window ventilation.

In considering the practicability of ventilation with untempered air it must first be decided what general temperature is finally to be maintained within the room. The advocates of natural window ventilation sometimes have in mind the maintenance of an ordinary room temperature of 65° to 70° by the admission of a small amount of cold outside air, and sometimes advocate a frank abandonment of high temperatures in favor of open-air rooms which approximate more or less closely the conditions which may happen to obtain outside. The second condition involves a problem for the hygienist and student of human efficiency rather than the sanitarian. There is obviously no mechanical difficulty in leaving windows wide open; in "unhousing," to use Dr. Evans's picturesque phrase. Open-air treatment has, of course, been used with success in hospitals and sanatoria and in open-air schools. It is advocated by physicians of high standing for all hospitals and for all schools, but not, so far as I am aware, for auditoria and factories. Basing my judgment on my own predilections and on the broad historical fact that mankind has always manifested an instinctive desire to keep warm in winter, I am somewhat doubtful whether indoor temperatures below 60° will ever become widely popular among normal human beings, except during sleep. If they do, the ventilation problem will be greatly simplified.

If, on the other hand, a temperature of over 65° is to be maintained, the cool air admitted for ventilation must be tempered, in any rooms which are at all crowded. With only two or three people in a room, as in an ordinary dwelling, window ventilation can be successfully operated with pretty constant care. In a school or a factory, however, where there is a row of 5 or 10 people extending from a window to the other side of a room, it is clearly impossible to ventilate by admitting untempered air in winter. Either the temperature near the windows will fall below 60° or the temperature at the other side of the room will rise above 70°, usually the latter.

I have been speaking so far of the maintenance of ordinary normal atmospheric conditions. The possibility of occasional temporary variations from this normal is another question. It is probable that sudden changes in temperature are stimulating and beneficial, and that a wind blowing over the body and dispersing the cloud of hot moist air which clings about it is certainly wholesome. Perflation, or the periodical flushing out of a room with drafts of cold air, is a good procedure, whatever normal conditions may be maintained. It has been suggested that by opening windows in this way often enough, say once an hour, the necessity for artificial ventilation might be avoided. This would mean considerable interruption, however, to any continuous work and, like ordinary window ventilation, would lead to sharp fluctuations, the temperature being either very low just after windows were closed or very high just before they were opened. I am inclined to think that perflation is most useful as a supplement to a system of ventilation rather than as a system of ventilation in itself.

We must recognize the fact that ventilation practice may differ very materially in different sorts of occupied rooms. In hospitals the conditions for natural ventilation are most favorable. The patients are compelled to accept what is thought to be good for them. They have no work to be interfered with and can be provided with all necessary clothing and covering to withstand low temperatures. They are not crowded. There are plenty of intelligent attendants to regulate window openings. Here, if anywhere, open-air treatment and window ventilation should succeed. In auditoria and offices and factories, on the other hand, the inclinations of the occupants must be considered, and in the latter the exigencies of more or less delicate manual work as well. Such rooms must be crowded and can rarely count on constant skilled supervision. Here air tempering is, I think, quite essential. Schools occupy a somewhat intermediate position. Only experimentation can perhaps show clearly whether children keep permanently well and do good school work when exposed to the changing conditions of a northern climate, accompanied perhaps by the dust and noise of a city street. The experience of open-air schools seems to indicate that subnormal children, with the special conditions of supervision, feeding, and medical care which have surrounded such experiments, are markedly benefited by the change, and further experiments along this line will be awaited with keen interest.

I have purposely said nothing about the mechanical method of supplying tempered air where tempered air is needed. It may be driven by fans from a central heating plant, and may or may not be supplemented by exhausts. Or, on the other hand, it may be supplied from exterior openings in the room provided with vento coils. Wherever air tempered to 60° is supplied, however, fans will probably be necessary to insure circulation in any crowded room, as temperature differences will generally prove inadequate.

(4) *Cool but tempered air must be evenly distributed within the space to be ventilated.*—In regard to air distribution, both natural and artificial ventilation have in the past too often been failures. In the one case, however, the difficulty is inherent, and in the other it is due to avoidable constructional defects. Barring the extreme case of the open-air school, where no temperature difference is maintained, it is obviously impossible in cold weather to insure good distribution by window ventilation in a room occupied by many people. The windows must necessarily be at the sides of the room, often at one side only, and there must be marked inequalities between conditions at the sides and at the center. On the other hand, as is evidenced in many auditoria, there is no serious difficulty in securing almost perfect distribution by mechanical means. Faulty construction is, however, far too common. This is a problem for the designing engineer,

and he must be in each case a true designing engineer, not the peddler of some quack "system" of ventilation. I can not forbear to call attention to some of the common defects which are often forced upon the attention of the sanitarian. They appear principally at four points, namely, in the construction of ducts, and in the size, in the location, and in the number of room inlets and outlets.

Main and branch ducts are frequently found to be constructed in defiance of every known law of air flow. They are too small or too large; they branch at improper angles; they coil round obstructions like unwieldy serpents. Often, some one else than the ventilating engineer is to blame for the last condition, but if he respects his work, he should refuse to be a party to its frustration. The careful experiments recorded in the second report of the British Departmental Committee on Ventilation of Factories and Workshops showed, five years ago, that the old practice of tapering main ducts to control air flow is a wholly mistaken one. They showed the vital importance of slanting branch ducts at an angle of 30°. Yet these principles are still violated in many systems installed in this country. The sizes of inlets and outlets for individual rooms are often woefully inadequate. In my own institution, a lecture room containing about 20,000 cubic feet, and seating 200 students, has four inlets with a total gross area of less than 10 square feet. Allowing a net area of 75 per cent, and a velocity of 3 feet per second, this gives only 750 cubic feet per occupant. The temperature at the end of a lecture is sometimes 80°. The faulty location of inlets and outlets, which is so common, is mainly due to the old plan of downward ventilation which makes ventilation for cooling an impossibility.

Most important of all, in my judgment, is the question of the number of inlets and outlets. I do not know just how many cubic feet of a room should require a separate inlet, but I am quite certain that it is impossible to maintain good air conditions for 50 people with one or two fresh-air inlets. Short circuits and air pockets occur and marked local differences of temperature exist in rooms ventilated on the ordinary school-room pattern. In contrast to this condition is the marked success attained in many auditoria by the supply of air under every seat, and in many factories, where inlets and outlets are freely distributed about the room. Just how far to go must be determined by studying the conditions of each individual case, but I think it is clear that multiple inlets and outlets must be used far freely than is now generally the case.

In all this I am of course suggesting nothing new. All these principles are carried out by the leaders in the ventilating profession, but so much rule-of-thumb work is turned out by architects and so-called engineers of a different order, that these facts must be emphasized in order to protect the whole art of ventilation from discredit.

The fundamental principles of the new art of ventilation, as I see them, consist, then, in the supply of a proper amount of air cooler than the air of the room, but tempered to a temperature above 60° by multiple openings, sufficiently numerous to give good distribution, and situated near the floor, with corresponding openings above for the removal of heated air. This is essential, and this is all that is essential for the maintenance of proper temperature conditions, and the prompt removal of odors and products of ordinary combustion and illumination.

There are other special problems of air conditioning which, though less important, are worthy of attention and are easily solved by minor additions to such a system as has been indicated. The first of these special problems is that of humidity. We have, so far as I am aware, no definite physiological knowledge as to the exact effect of dry air upon comfort and health. Very dry climates are often particularly healthful; but, on the other hand, the warm, dry air of our houses and schools seems to exert a distinctly unfavorable effect on many individuals. They find the dry atmosphere overstimulating and conducive to nervousness. It is said that the mucous membranes are clogged by too rapid evaporation, and that diseases of the nose and throat result. We greatly need scientific study of these points. Meanwhile, however, there seems to be a sufficiently strong consensus of popular opinion to warrant provision for humidification, at least in hospitals and schools. At the Horace Mann School, in New York, very careful observation of the sensations of the occupants have led to the adoption of a mean temperature of 66°, and a relative humidity of between 55 and 60 per cent, with general success, so far as comfort is concerned. Artificial humidification may now be provided by any one of several methods with reasonable certainty and at reasonable expense.

Another point which is worthy of attention in certain cases is the washing or filtering of the incoming air to free it from its burden of dust. In libraries, telephone exchanges, dairies, and other buildings used for special purposes, this may be essential. In hospitals and schools it may be desirable under certain conditions. In a recent study of the air of certain New York schools, Prof. Baskerville and I found averages ranging from 610,000 to 760,000 dust particles per cubic foot in the air of five different schools, with maxima running up to nearly 2,000,000 particles per cubic foot. This was in spring with window ventilation only. I know of nothing that would lead me to believe that these particles in such amounts are injurious to health. If, however, their removal is desired, it can easily be accomplished.

One point which I do believe deserves much more attention than it has generally received is the possibility of air conditioning in warm weather. It is somewhat strange that we freely pour out money to heat and even overheat our buildings in winter, and seldom think of cooling them in summer. Yet one procedure is quite as practical as the other, and perhaps more important from the standpoint of public health. At the banking house of Kuhn, Loeb & Co., in New York, A. M. Feldman has designed the heating system so that it may be used for cooling in summer. A temperature about 10° below that of the outside air is constantly maintained and I am told that the firm finds just one serious trouble with the plant, and that is that people who come into the office in hot weather can never be persuaded to leave it. The Mount Sinai Hospital in New York has planned a special cool room for young children, and, in view of the direct relation between heat and infant mortality, there can be no doubt of the value of such a provision. Two of the new hotels in Chicago are equipped with cooling plants. If we should cease to accept summer heat in buildings as a dispensation of Providence and in each case balance the cost of artificial cooling against the advantage to be gained, this procedure might be used to an extent now undreamed of.

The problem of operation will always remain to be considered. No amount of skill in designing will ever produce a ventilating system that is fool proof. Notatably successful results can be achieved only by constant supervision. Thus, at the Horace Mann School, in New York, excellent conditions are maintained through the keen interest of the superintendent of buildings and grounds, in spite of certain features of construction which seem to me unfortunate. Huntington Hall, at the Massachusetts Institute of Technology, is famous for its "good air;" and the reason is that Prof. W. T. Sedgwick takes personal charge of the temperature arrangements and watches the thermometers in the hall during the Lowell lectures which are held there. Such supervision as this is of course neither generally practicable nor generally necessary. An engineer or janitor intelligent enough to read a thermometer, and conscientious enough to obey orders, is all that is necessary, but the political derelicts who sometimes drift into school janitorships do not always meet even these simple tests. Even with good janitorial assistance, however, it would be highly advisable for every new plant to be operated for a short time under the supervision of its designer, with careful studies of results as regards temperature and humidity and circulation. After such tests, clear and simple rules for operation could be formulated, which would give reasonable assurance of success; and they would prove of inestimable educational value to the engineer himself.

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THE EVOLUTION OF THE HANDLING OF PERISHABLE PRODUCTS, ESPECIALLY AT THE SOURCE OF PRODUCTION.

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The last decade has seen great accomplishments in the upbuilding of a widespread sentiment in favor of unadulterated foods, and a demand on the part of the people that laws be passed and enforced to protect consumers against the unscrupulous manufacturer or dealer. However, as we accumulate knowledge concerning the sources and manipulation of the food supply, it becomes apparent that another element has entered into the problem, namely the saving of foods which are now wasted and the maintenance of quality between the producer and the consumer. Asia has starved for centuries with a disregard of life that is born of hopelessness; Europe has faced famine year after year, learning by the constant menace to utilize much that we consider inedible. The United States, viewing her broad prairies and acreage of arable land, has smiled and passed the question by. But now the pinch of scarcity has come to us also. Statesmen, financiers and economists are considering with consternation the problem of a future food supply. It is not enough that our people shall have pure food. They must have plentiful food as well if the development of the race is to proceed along progressive lines. We must increase production and, what is just as important, we must save what we produce.

Hence food control must be two sided; the one dealing directly with the violations of the law, in the nature of things essentially destructive, and the other dealing with the acquisition of knowledge and its practical application for the improvement of conditions. There results an evolution of industries enabling them to produce better products with profit to themselves as well as to the community. Such we may designate the constructive side of food control and to it, assisted by the law to restrain the incorrigibles, we must look for the greatest achievements in the future.

In order that we may appreciate the extent of the investigation necessary to a comprehension of the complexities confronting us, let me review quickly some of the conditions which prevail in the transference of foodstuffs from the producer to the consumer.

First and foremost is the fact that we have piled our people 20 stories high in restricted areas and such colonies do not produce anything edible. There is also a lamentable ignorance on the part of even the educated portions of such communities concerning the sources, value and quality of the foods they buy. The American public demands practically the same diet the year round and, thanks to refrigeration which the public scorns, it is getting what it demands.

The territory which must be drawn upon to feed our large cities becomes wider and wider each year. New York and our Eastern seaboard cities draw upon Georgia for peaches, Texas for onions, Iowa for eggs, California for fruits and Washington for fish. It is an extremely difficult matter to estimate the average distance from which New York gets her food supply, yet it is probably conservatively stated when placed at a four-day haul by fast freight. Adding to this the fact that from one day to several weeks are required in the producing sections to collect the produce and get it shipped and from 24 hours to a year after the city is reached to get it to the consumer, it will be seen that the element of time as well as of distance must be reckoned with. When one remembers that, to all intents, the public expects the same lasting qualities in such unstable products as Pacific halibut and Missouri broiling chickens that it does in wheat and winter apples one begins to catch a glimpse of the breadth and depth of the problem.

It becomes perfectly obvious too that the industries involved must themselves apply the best refinements that science can offer if waste is to decrease and quality increase, and that condemnations and seizures by food inspectors can help those concerned but little in solving this phase of the question.

What has already been accomplished along constructive lines has been done by investigators having a training in pure science or in agriculture, which latterly has become so broad that it demands a knowledge of many sciences. The field of work is two-sided—the laboratory, to which every question must be referred for the underlying facts that will solve it, and the orchard, packing house or other industrial center where the industry is doing its work. The facts obtained in the laboratory, shorn of their scientific verbiage and expressed in the language of the industry, must be taken to the industry by men who, never forgetting their determination to improve conditions, can yet present facts and objects in such a way that the industry will follow where they would lead because it has faith and because their achievements directly or indirectly benefit it.

This is the kernel of the so-called cooperative work which the United States Department of Agriculture has carried on to improve the condition of the food supply, in the hope that it will ultimately control itself. It is more profitable for the producer to get foodstuffs to market in good order than in bad and he wants to learn how to do it. Such a desire on his part, supplemented by the knowledge imparted to him by investigators, is a more potent influence for the output of good products on the part of a great majority of the industry than is the fear of a transgressed law.

The question is frequently raised "why do not the industries work out these fundamental principles for themselves? Why, since the industries participate so largely in the benefits, should municipalities, States and the Federal Government use their funds for this purpose?" The reasons are many: the agriculturists and their immediate followers in the chain of distributors, all handling business on a small scale, do not individually have funds for such work, even if they have the kind of education which shows them that they need it. Collectively only one agricultural industry is sufficiently advanced to provide funds to push such work, namely the citrus fruit growers of California. They have reached this degree of broadmindedness by having the Federal Government do for and with them the most remarkable piece of constructive work in the handling of a food product that is recorded in agricultural history. Again, conditions must be studied in many places; one packing house, one orchard or one territory is frequently only misleading when deductions are applied generally. Manifestly broadcast operations on the part of individuals are impossible under present conditions of business competition.

Probably the most cogent reason for this constructive work by State or Federal Governments is the public faith in their recommendations. This is because of their disinterestedness as personalities and because the distributing system for foodstuffs is so complicated, covers so many miles of territory and involves so many separate business enterprises that only a public official of unimpeachable character and affiliations can ever gain the confidence and trust of the many competing elements. Without that confidence the investigation is merely a collection of scientific data and a recital of facts. As a means of bringing about a better system of things or of upbuilding, it is a miserable failure. It is far more difficult to get the facts to the industries in such a way that they can understand them than it is to get those facts themselves. The constructive study of the handling of citrus fruits, to which reference has been made, is a forceful illustration of this statement.

Ten years ago the oranges and lemons of California were a drug on Eastern markets because of the high percentage of decay. The growers blamed the railroads, the soil or the climate and tried various schemes to overcome spoilage, all of which were inadequate. The American lemon had no standing in the American market. Investigators from the United States Department of Agriculture, trained to observe conditions and correlate findings, soon found that mechanical injuries to the skin of the fruits permitted the entrance of spores of blue mold, hence the decay. The remedy was, perforce, to prevent mechanical injuries—a simple-sounding cure but one which meant a revolution in handling from the picker in the orchard to the distributor in the city.

The Californians very soon found that the young men sent to study the problem had a more accurate knowledge of it than the growers themselves; that they were broadminded, trustworthy, and in spite of their devotion to the object to be gained, had yet a persuasive tolerance for the conservative or doubting members of the industry. Plain humanity, struggling under difficulties for bread and butter, has never yet been able to withstand such assistance so offered. The growers gloved the hands of the fruit pickers, altered the construction of the clippers, put springs under the wagons, and in diverse ways protected the orange skins. The packers swept out of the houses the complicated machinery that had rolled and bumped and squeezed and dropped the fruit while it was being graded and boxed. The contract system of labor which was largely responsible for prevailing conditions, was practically abolished. Boston, New York, and London now buy California oranges the year around, with an eye to juiciness, flavor and size; the question of decay has almost ceased to be a question. Furthermore, the only crop-producing lands in the United States which approach the citrus orchards in money value are the apple orchards of the Northwest.

Here again in these far-off apple lands is a confirmation of the fact that when the producer of perishable products is forced by circumstances of trade to apply good methods of handling quality and quantity of output increase and waste decreases. The apples of the New England hillsides, which are unexcelled for quality and which are surrounded by a consuming territory, rot by the ton, because, first of all, the fruit is deficient in condition, and therefore the financial returns do not justify concentrated efforts for its successful marketing. Prune and spray the trees; gather, grade and pack the New England apples with the exactness and skill that has been developed by cooperative constructive work in the far-distant markets of the Northwest, and see how many abandoned farms remain abandoned.

Good handling, combined with refrigeration, worked out and applied to southern peach growing by the United States Department of Agriculture, has helped to make a great industry for the South and has supplied the North with the luscious fruit. The same force of investigators have succeeded in getting Oregon raspberries as far as Minneapolis in good order; they have extended the shipping radius of cherries; and they have succeeded in so handling, packing, and refrigerating grapes that our American varieties can be kept to increase the bounty on our Christmas dinner tables.

In every case these problems of the handling of fruits have been tried out and established cooperatively with the industry in some territory rich in the especial fruit under investigation. The principles have been extended to other sections and in greater or lesser degree the whole country has profited, but striking results are not often seen when markets are near by or where there is a lack of cooperation among the growers.

The current agitation for pure-food products has led the department to study, with the canning industry, some canned and preserved foods to the betterment of the product, the education of the industry, and the assistance of the public officials charged with the enforcement of pure-food laws. For instance, maker's of tomato catsup have been shown what kinds of stock are responsible for the molds and bacteria that make the preservation of their product difficult, how to eliminate such stock, and how to improve the methods of washing, grinding, etc. In some of the catsup-making establishments a microscope enabled the men to grasp and assimilate the fundamentals of cleanliness and awakened a real ambition to prepare a high-grade product. The same general principles are being applied to the study of canned fruits, this industry also lending the hearty support of its organization. One has only to read the reports of its representative associations to see that its sentiment and endeavors are directed toward purity and high quality. Perfection is still far away, but the receptive mood has been established.

Consider, now, another illustration of constructive work on the handling of two perishable products, namely, dressed poultry and eggs. The conditions here are entirely different from those prevailing in the other industries discussed. Poultry is kept on 90 per cent of American farms and is almost exclusively a side issue on those farms. It is sold by the farmer to the huckster, agent, country merchant, or near-by poultry shipper, by whom, ultimately, it is forwarded to market. It is dealt with in small lots in the rural districts. In the East these small lots are shipped alive, in coops, or dressed, in barrels, to near-by markets. In the West there are concentrating points—usually packing houses—where the dressing is done, and the goods forwarded by the carload. The Middle West provides the poultry for the rest of the country. Local supplies elsewhere are only a small part of the total amount. The poultry which is shipped alive to eastern cities is almost exclusively for the Hebrew trade. New York gets the bulk of it. The haul is likely to be from five days to two weeks and the condition of the fowls on arrival bad. It will be seen that this is a widely scattered, unorganized industry, composed for the most part of untrained men who have put almost as much energy into warring on one another as into the conduct of their business. The annual value of poultry and eggs is about $750,000,000. The capital invested by the men who dress, pack, and ship the goods is, by comparison, a negligible sum. Until within a few years a shed, a few coops, some barrels, and a few hundred dollars' credit was all that was needed to start business as a full-fledged poultry shipper. Is it any wonder that 10 per cent of the poultry and eggs produced on the farms are lost by decay before the consumer is reached, or that the market is full of low-grade stuff? It is perfectly obvious, too, that such an industry is powerless to raise itself without some stimulus other than that met with in its daily life and that it must have some assistance.

Five years ago the department began to study the methods in vogue for the handling of dressed poultry. That study took the investigators into every branch of the industry—dressing, transporting, warehousing, and distributing. Of dressed poultry, per se, these investigators knew not one thing. They did know the underlying chemical and bacteriological principles for the prevention of decay in flesh and they had been trained to do research work, to correlate facts, and to "sink trifles and know solid values." The industry, as an industry, looked askance at any interest displayed by anyone linked with any sort of food control. A few cold-storage warehousemen, knowing of the value of the cooperative work of the department in fruit handling, stood sponsor to the industry for the department's honesty of purpose. Whether betterments would follow no one could say. The study was begun with a few of the best equipped and most progressive poultry packers and one by one all the links in the long chain leading to the consumer came into view and were freely available for investigation. The links between the packer and the consumer are another story; this paper must confine itself to the work at the source of production.

Chickens come to the packer alive, and therefore free from decay. It was our problem to keep them so. To fix the scientific principles involved every step in the dressing was worked out in the laboratory. That almost invariably determined the most efficient course to pursue. Then came its application under commercial conditions and, finally, on a commercial scale. The industry, in a continually widening circle, watched the practical results with a growing interest, and in most instances, an unconscious absorption of the essentials of the principles for the preservation of flesh.

Cleanliness has come to be looked on as a commercial asset, and not merely the personal preference of the manager of the house. Bacteria and their sources have become tangible facts, to be reduced to a minimum by definite lines of procedure. Refrigeration has become an all-pervading practice to be used with scientific accuracy. Signs of decay in the product are no longer to be hidden, condoned, or denied. Any undesirable result is to be brought out and freely discussed in the hope of obtaining information by which to better it. There is a growing conviction, that if the packer is to hold his own in the dressed-poultry market, adequate facilities must be available for the handling of dressed poultry according to improved methods. As he awakens to the need of refinements in his methods, and to the extreme delicacy of the material that he handles, he comes to hold a more reasonable attitude as to the condition of his goods when they reach the market, and he personally investigates their comparative standing there. In so doing, he becomes acquainted with a broader phase of the industry than he could acquire in his own restricted territory. His mind then turns from devising methods whereby a competition in restraint of trade can be kept up, to the broader, saner ideas of legitimate cooperation. Such a remodeling of ideas has resulted in the formation of many organizations, both local and national, for the mutual benefit of their members through the better understanding of common problems and purposes, education, and a closer relation with State and Federal bodies having to do with the control of the food supply. These organizations do not deal with the question of prices.

Let me present one more illustration of cooperative constructive work to show, especially, extreme cleanliness in the handling of a foodstuff, and the application of the principles of the bacteriological laboratory to the betterment of the food supply. This concerns the removal of egg substance from the shell and its subsequent freezing or drying for preservation.

The disrepute into which this industry has fallen, due to the filthy products put up by disreputable men, is too well known to need further comment. The task before the department has been to study this industry from its foundation and, if possible, to devise methods of handling that would carry eggs in wholesome condition to the consumer; also to save just as many eggs for the food of the people as is consistent with wholesomeness. There came the rub. To save, all over the land, wholesome food for the people! What mattered it to the people if the most perfect of methods was worked out unless the industry could and would apply those methods? We know that the fundamentals of handling eggs out of the shell are the principles of bacterial cleanliness, just as handling milk out of the cow is based on aseptic principles. But for the industry to put those principles into practice was another matter.

The frozen and dried egg industry is large. The higher types of men in it were more than willing to cooperate with us in our investigations, and offered all the commercial facilities at their disposal for the untangling of the problem. We knew that if we could devise a practical system of handling eggs the industry would adopt it. Impracticability meant failure. To begin operations we went to the producing section, because this is the place to cut down waste. We made bacteria realities by showing everybody in the packing house how they looked in colonies, and how multitudinous they were on fingers, shells, cups, buckets, and every other spot that afforded them food and moisture. Their scarcity, when cleanly methods were employed, furnished the desired contrast. When the breakers had seen thousands of colonies develop from the touch of wet, dirty, finger tips, from the drippings of egg slopped on utensils, and from the edges of cups washed in the ordinary way, it was an easy matter for them to grasp the significance of three or four hundred million organisms in a quarter teaspoonful of rotten egg, and the damage that even one drop of that egg would cause, if it should get into the food-egg bucket. Cleaning up, too, after breaking a bad egg, became more than a troublesome routine enforced by a foreman. After encountering a bad egg, the girl washes her hands, wipes them on a sanitary towel, gets clean apparatus, and proceeds with her work until another objectionable egg is found, when the cleaning-up process is repeated. The success of her work depends in great part on the cleanliness of her fingers. Weeks of exquisite cleanliness meant white hands and pink finger tips and smooth nails. When they had been acquired the "eternal feminine" asserted itself, and we had no more trouble with hands. The dainty handling of the egg while emptying the shell is pretty to watch, if fingers are rosy. A few compliments to those who deserved compliments, and again the "eternal feminine" accomplished more than days of argument or demonstrations.

Undue haste in certain movements on the part of the breakers means loss of egg material or inaccurate grading; slowness in other movements means added cost to the packer, hence, to the consumer also. Every motion, therefore, was studied by means of a split-second timer; hastening here, retarding there; working in tenths of seconds, so that the product might be wholesome, and that expended energy might return the most efficient results.

It is difficult to imagine a greater contrast than is presented by these quick, accurately moving girls, white capped, white gowned, alert, intent, and the slovenly, wet-handed, frowsy-headed, careless, inconsequent crew that we found in more than one egg-breaking establishment. The establishments themselves, however, have undergone as great a change. We found ordinary rooms with wooden floors and ceilings, open windows, and sinks for washing utensils side by side with mixing buckets. We have now, in a number of plants, concrete, white-enameled, refrigerated, fly-proof rooms; sanitary tables; especially constructed apparatus for breaking eggs; glass sherbet cups to receive them; fresh buckets to collect them; special mixers to stir them; and clean cans in which to send them to the freezer or the drying machine. We have wash rooms where every utensil is not only made as clean as water can make it, but is afterwards sterilized in steam at a temperature of 210° to 212° F. for 20 minutes. A cup into which a bad egg has fallen is taken at once to the wash room and is sterilized before it is again put into service. So is the knife on which the egg was broken.

All of the eggs which are broken at the source of production would deteriorate before reaching the consumer if they were not so preserved. Many of them would be lost as a food. They are the lightly cracked eggs, the shells of which are too imperfect to protect the contents during shipment; dirty eggs, the price of which on the market makes it unprofitable to ship them; "heated" eggs; that is. the summer egg which has begun to deteriorate on the farm, and which must be used at once, if it is to be used at all. There are millions of these eggs lost each year, generally because they are shipped, and spoil completely before they reach the consumer. The time will come when such eggs will be universally conserved at the source of production.

These are but a few of the investigations tending toward constructive ends that are being carried on by the United States Department of Agriculture. In every industry with which the work has been conducted cooperatively a new era has opened for the industry and a better era for the consumer. Foes of food control, because of misunderstanding of purpose and the prejudice of ignorance, have been changed to friends in hearty accord with its ultimate aims. The more of them we have, the better will be the food supply of the people. The more knowledge we can disseminate in the industries, the less will be the destruction and waste of foodstuffs. Here, as in other questions of life, "ignorance is the curse of God; knowledge the wing wherewith we fly to Heaven."

A SANITARY REGULATION OF INDUSTRIAL ESTABLISHMENTS MANUFACTURING OR HANDLING FOOD MATERIALS.

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During the year 1911 the food-control officials of the United States reported the results of 122,216 sanitary inspections of food producing and distributing establishments. This work was confined to 20 States. Prior to 1909 no work was being done in the country which could properly be included in such a report. These data alone show the development of the idea, among food officials, that food control should no longer be confined to the suppression of fraud and misrepresentation, but should be extended along the far more important lines of sanitation. This work has grown up as a result of the passage of the so-called uniform sanitary food law, which, in its exact or in a satisfactorily equivalent form, is now a statute of 22 States and of the District of Columbia.

The work being done by State authorities is, as a matter of fact, but a small part of the sanitary food control of the country, for every community, through its health officers and inspectors, is naturally more or less successful in handling its local problems. In the larger cities of the country excellent systems of food inspection have been developed, and the aggregate volume of such work, if it could be recorded, would definitely establish the recognition by food and health authorities of the all-important problem of regulating the sanitary conditions surrounding the manufacture and distribution of the food supply. When we recall how recently this work has been developed it is somewhat mortifying to remember that Moses laid down splendid sanitary laws for the children of Israel 3,400 years ago, and that long before the Christian era Rome and Athens had meat and market inspectors. But if we have been a long time in establishing the very necessary regulations, it is none the less creditable to those States which have taken up the work in earnest to know that the laws are being efficiently administered. Probably the best example of sanitary food control is that furnished by the activities of the Bureau of Animal Industry, through its Meat-Inspection Service, in the regulation of the meat supply. In the care of meat and meat products entering interstate trade the Federal Government has developed a system of inspection, both of the raw product and of the finished material, as well as the conditions under which the business is carried on, that can hardly be improved. Unfortunately, inspection is afforded only for meat products which enter interstate trade, and at least 50 per cent of the meat food of the country is prepared in local abattoirs which are uninspected and unregulated except by occasional visits by local authorities. But a discussion of an inspected meat supply is a subject by itself, and need not be further referred to here. In general, the present-day food manufacturer and distributor are accepting without protest, and indeed in many instances with enthusiasm, the ideas of the sanitarian.

It is still not unusual to hear the remark: "If you saw it made, you would never want to eat it again." Modern food factories, however, are being constructed and run on the theory: "If you see it made, you will buy a case." These comments, with such antagonistic conclusions, represent well the changes that have taken place in food manufacture since it came to be understood that visible dirt is not the most dangerous, and that the invisible yeasts, molds, and bacteria are the evidences of uncleanliness that, if allowed to develop, will turn good raw material into garbage and carry poison instead of food to the consumer.

The production of sanitary food depends much upon the kind of raw material and the character of the output. A flour mill and a dairy are as unlike as two businesses can well be, and yet they must conform to the same laws, and alike turn out a clean and wholesome product. It will be well, therefore, so far as possible, to classify food-producing establishments according to the nature of the output. This may be subject to almost immediate spoilage, as in the case of milk, meats, fruit, bakers' goods, and cooked foods ready for the table. It may be protected from deterioration by being placed in sterile containers, as is the case with canned goods, bottled beverages, and the like. It may be treated with preservatives which arrest decay, as in smoked meats, salted fish, pickles, and butter, or it may be of a nature not readily subject to the effects of keeping, as is flour, dried fruits, sugars, sirups, confectionery, cereal products, spices, tea and coffee, oils, and a great variety of common and much-used foods. These four classes of food, which may briefly be described as perishable, sterilized, preserved, and nonperishable, are made from such a variety of materials and prepared by such varying processes that the principles of sanitation to be observed with each are widely different. Certain absolute necessities are, however, common to every class, and may be outlined as follows:

The first essential is a correct type of building, made of suitable material, provided with proper light, heat, ventilation, sewage connection, and water supply, so located as to have satisfactory transportation facilities, an ample supply of raw material, and a receptive market. The next desideratum is a well-designed equipment, properly installed, provided with suitable power, and so built as to be readily cleaned.

The third essential, perhaps the most important of all, is a corps of skilled operatives who are cleanly in dress and person, whose habits of life are clean, and who are not afflicted with venereal or any loathsome or contagious disease.

The fourth requirement is a sound, matured, clean raw material.

Having then in a general way established a classification of food products and certain essentials to their sanitary production, what methods of operation must be followed to avoid spoilage of material in the factory and its contamination during distribution? Each class, into one of which most food manufactures may be placed, can perhaps be studied by itself with better results than by drafting some general code of sanitary requirements that will fit all cases; so separate treatment is, therefore, essential.

PERISHABLE FOODS.

The changes which take place in food when it "goes bad" are due exclusively to the growth and multiplication of molds, yeasts, and bacteria, and to the production of deleterious or offensive material as a result of the activity of these organisms. Perishable food is food which offers most satisfactory conditions for the growth of these organisms, such as the presence of proper food material, sufficient moisture, and a temperature at which they will grow. Such food must, therefore, be prepared in such a way that the number of organisms which may attack it is kept at a minimum, and that the product as it leaves the factory is protected against further invasion by the maintenance of a sufficiently low temperature to check bacterial growth. Speaking generally, bacterial growth rarely takes place below 10° C. Nearly all bacteria are killed when subjected to a temperature of 65° C., although their spores are not destroyed except at temperatures of 100° C. or over. Such perishable goods as milk and the usual products of the bakery and kitchen are protected against spoilage by heating them to this destructive temperature, as in the pasteurizing of milk and in the cooking of food for the table; but fresh meats and fruits are distributed raw, and refrigeration is resorted to in order to hold the growths or organisms in check rather than to destroy them.

But even when such precautions of high and low temperature are observed they can not alone produce a sanitary food, and factory conditions must be such as will admit of perfect cleanliness. In the construction of the building the most important essentials are abundant light and good ventilation. The action of light, especially of sunlight, is injurious to many forms of microorganisms, and renders it impossible for filth to accumulate unseen. Proper ventilation insures the absence of foul odor and is also an incentive to cleanliness. The next requisite is an abundance of water and proper sewage connections, arranged to allow a thorough flushing of all floors at the end of each day's work. In the dairy a flushing of the stable is not yet followed, except in unusual instances, but in the canning factory and abattoir it is the greatest agent for the removal of the organisms which cause decay, especially if, after being scrubbed and flushed, the floors and apparatus are treated with live steam. The floors should be constructed of nonabsorbent material, preferably of concrete or cement, and so pitched that water will properly run off to catch basins and sewers. The side walls and ceilings should be either well plastered, wainscoted, or ceiled with metal or lumber, and be oil painted or lime washed. Oil paint is much to be preferred to whitewash, as it can be washed clean with soap and water. It is also more adhesive and does not scale off and fall into the food material. Doors, windows, and other openings must be fitted with self-closing screen doors and wide window screens of a mesh sufficiently small to exclude all flies and insects which might otherwise gain access to the food and contaminate it. A 14-mesh wire gauze is sufficient for this purpose. In the construction of trucks, trays, platforms, racks, tables, and the necessary apparatus the simplest designs should be followed, and they should be so built as to be easily taken down and thoroughly scrubbed and cleaned as often as is necessary. All toilets and lavatories must be built outside the rooms where the processes of production, packing, and distributing are carried on. The toilets should have separate ventilating flues or pipes discharging either into soil pipes or to the outside of the building in which they are situated. The floors of the toilet rooms should be of cement, tile, brick, or other nonabsorbent material, and should be washed and scoured daily. The lavatories and washrooms should be adjacent to the toilet rooms and should be kept supplied with soap, running water, and towels. An imperative order should be issued, and rigidly enforced, requiring all operatives and persons who handle either the material from which food is prepared or the finished product to wash their hands and arms thoroughly in clean water before beginning to work or after visiting the toilet.

The use of cuspidors is not necessary and is in most instances undesirable. Wherever it is necessary that cuspidors be provided for the use of operatives, they should be emptied and washed out daily with a disinfectant and a sufficient amount of the solution left in each cuspidor to keep it antiseptic. The practice of expectorating on the floor, walls, or about the building should be prohibited.

It is a discredit to the food-producing industry that many conditions have been allowed to exist which were in every way inimical to the health of the operatives and certain to lead to the production of impure food. The condition of bakeshops, for instance, has been most unsatisfactory. In 1907, 43 per cent, or 582, of the bakeshops of Chicago were located underground, in poorly ventilated rooms, wholly shut off from daylight. In many cases the work was done in the foul air of badly lighted and unclean rooms. Two hundred and eighty-two of these dungeons have already been abolished by the department of health of that city, but proper sanitary conditions will not be possible until every one is closed and the industry is driven above ground. But even if food is produced by competent workmen in a well-equipped and operated shop, it must be cared for after being distributed and guarded against contamination up to the time it is consumed. Restaurants and hotel dining rooms and kitchens are far too frequently improperly managed, and their condition, when contrasted with the kitchen and the dining room of a tidy housewife, shows a marked difference in cleanliness of operation in favor of the home. The chief reason why home-cooked food is clean is the care that is taken to protect it from dust, dirt, and flies. The same care can, and should be, observed by the baker, butcher, grocer, and hotel steward.

STERILIZED FOODS.

This class of foods includes all goods put up in air-tight containers, such as the bottled beverages and canned goods. While the treatment at high temperature needed for sterilization destroys yeasts, molds, and bacteria, and thereby renders unnecessary the observance of many of the sanitary requirements which are essential to the production of perishable foods, yet the raw material used is not greatly different and must be carefuly handled in order that deterioration and decay may not begin before the process of manufacture is completed. For instance, in the operation of a canning factory used for the production of tomato products or other canned vegetables the construction of the building should be similar to that already described. It should be equally well lighted and ventilated and provided with facilities for proper sewage disposal. The floors should be constructed of nonabsorbent material and should be thoroughly flushed at the end of each day's operation. The construction of the side walls and ceilings need not be as expensive as in buildings devoted to production of perishable goods, but they should be tight and clean and sufficiently smooth so as not to become dust laden. Certain classes of products which are put up in sealed containers, especially meats, fish, sirups, sweet, juicy fruits, and vegetables, attract flies in enormous numbers and a thorough and efficient screening is absolutely essential. Toilets and lavatories should be provided and properly cared for, and the order requiring cleanliness of person should be insisted upon.

In some operations, such as those connected with the brewing industry, special care must be taken to prevent the contamination of material in the processes of manufacture by wild yeasts and molds, which, by their growth, destroy the character of the product. In fact, the sanitation of a brewery is a business in itself and can not here be described in detail.

PRESERVED FOODS.

Preserved foods are those which are treated with chemicals which arrest decay, such as salt, vinegar, and sugar, dried until all moisture is removed, or smoked. As a class, establishments producing these goods are not carefully operated, dependence being placed upon the chemicals to preserve the materials handled. Certain industries, such as those connected with the treatment of fish, are notoriously poorly equipped and badly managed from a sanitary standpoint. The disposal of refuse material, the care used in cleaning machinery and equipment, the facilities for proper storage, are commonly inadequate. The use of the so-called antiseptic preservatives, such as borax and benzoate of soda, has been common in these establishments and they have been employed to supplement the natural preservatives, largely because of inefficient processes and careless methods of work. When meats, fish, pickles, butter, and all other foods which are chemically treated with salt, vinegar, or spices are prepared in a properly constructed building, of a kind which has been described as essential to the production of perishable food; when waste material is immediately disposed of, instead of being allowed to accumulate on the floor and apparatus; and when the value of water and steam as a sanitary prophylactic is realized, the manufacturer finds no necessity for using any additional preservatives. As in the case of other foods, the sanitary requirements may be summarized as follows: Well-constructed building, good light and ventilation, prompt disposal of refuse, cleanliness, trained and efficient workers.

NONPERISHABLE FOODS.

It is very difficult to outline the sanitary requirements of an establishment devoted to the production of nonperishable foods, as this class is very large, and includes a great variety of products. A flour mill, for instance, even though poorly equipped and badly managed, manifests itself in the grade of the output rather than by lowering its sanitary value. Special attention should, however, be paid to the proper cleaning of apparatus, and to protection from the attacks of animals and insects. An adequate supply of light and air is not as essential as in the case of the preparation of foods which deteriorate readily, but the careful manufacturer will always see to it that the health of his employees, as well as the character of his output, is protected. Plenty of fresh air and sufficient light are essential to this end.

Many nonperishable foods are packed in boxes or cartons, and much ingenious machinery is used in handling such foodstuffs But certain goods can not be packed except by hand, and it is therefore most essential that these products, which go direct from the package to the consumer's table, should be handled only by the cleanest operatives. When care is not taken to employ operatives who are free from disease, the danger of infection through such food supply is great. All employees who handle these goods should be provided with clean clothing, and their hands and arms should be kept clean. In certain classes of industries the hair should be protected by the use of a tight-fitting cap. Any operatives suffering from colds, or whose hands are cut or sore, should be refused work until they have recovered. The matter of cleanliness and perfect health is so important that each foreman should be held as responsible for it as he is for the volume of output. Certain manufacturers, realizing the hygienic necessity for care in this respect, provide their operatives with a clean uniform each day, and with suitable caps, and see to it that their hands and nails are manicured until the most fastidious can not object to the handling of their foods by such well-equipped and carefully inspected workmen.

In the development of the food-producing industry, the chief endeavor has been to secure volume of output at a minimum manufacturing cost, and, so long as the consumer has been uninformed and disinterested, the products have found a ready sale, but, under new sanitary conditions imposed by stringent legislation and awakened public interest, the successful manufacturer of the future must study the sanitary side of food production just as he does new methods for reducing cost or increasing output, and the most successful manufacturer will be he who removes from his gates and doors the "No admittance" signs, and opens his factories to the inspection, not only of the official, but of every consumer who may wish to see his food prepared for market.

What I have said relates almost wholly to sanitary conditions at the factory. I see, however, urgent need for the extension of our ideas of sanitation to a point where we shall be not only supplied with sound food made in a sanitary factory, but where the workmen, whether they be operatives, salesmen, or distributors, whenever their occupation may bring them into contact with the food supply, will be known to be free from disease. Other addresses before this congress have been devoted to the subject of bacillus carriers, and the literature of modern medicine is overloaded with the epidemiology of disease transmitted through the food supply. Knowing these facts, is it not high time the consumer should be protected by an examination of these workers, either physical or medical, or both, the positive results of which would make it prohibitive for the typhoid carrier, or for the man suffering from tuberculosis, or venereal disease, to work with food?

We have recently inquired of the health officials of every large city of this country, and of the largest cities of the world, as to whether or not they were requiring certificates of health from such employees. We have been amazed to find that not a health department of any city insists upon such certificate. The man who enters the United States Army must be able-bodied and sound in health; the motorman in the street-car service must be sound; but, at the present day, the baker who makes the bread, the driver who delivers it, the grocer and his clerk, the candy dipper, and the girl who packs crackers in cartons, the cook, and the waiter, are uninspected and their condition of health unknown. The annual convention of food commissioners held in July at Seattle recognized the necessity of such a certificate of health, and went on record as favoring compulsory examination, as a preliminary requirement to employment, and further examinations repeated sufficiently often to make sure that the worker with the food supply is always sound in body and physically and morally clean. The time is not far distant when the food manufacturer and distributor, the hotel proprietor, and restaurant keeper, will recognize their duty to the public, and the good business policy of eliminating the physically unfit from the ranks of the handlers of the food supply.

THE SANITARY AND HYGIENIC ASPECTS OF THE COLD STORAGE OF FOODS.

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In nature's cycle, all organic matter is doomed to the more or less rapid decay which is brought about by various physical and biological forces. The rate of deterioration is proportionate to the degree of favorable amounts and combination of these forces, and their time periods of action.

The greatest of these purely physical elements or forces are water and warmth, and the essential biological factors are living microorganisms and nonliving ferments, or enzymes.

The best methods for the preservation of foods consist in the partial or complete withdrawal, or the elimination of one or more of these forces or elements from the food product or its surroundings.

It is obvious that a thorough understanding of the physical, chemical, and biological laws governing both the decay of food materials and the prevention of actions of such processes is required, before a full appreciation of the significance of each step in the processes of food preservation by refrigeration can be obtained.

Until recently the science of the refrigeration of foods was on a purely empirical basis, and, in fact, it is largely so even now. With but few exceptions the investigations of the effects of refrigeration have had for their object the determination of the character of the end results. Only slight efforts have been made to elucidate the nature of the forces and the methods of their action.

In the absence of results of scientific investigations of these processes, it is not astonishing that large groups of the American people have been led by certain designing individuals to believe that cold storage of foods was conducted solely for cornering the food markets. Others have been almost conclusively taught by retail dealers that cold storage was responsible for all the low grade or deteriorated foods which the dealers desired to sell off before they became too obviously unfit for consumption.

Every profession or industry based upon empiricism is almost defenseless in case of attacks by demagogues and charlatans. The remedy is clear. Not only obtain and show results, but investigate and demonstrate the laws which operate to produce them. In other words, develop and disseminate the science of the industry.

With the wild call of the people for the regulation of this business of cornering foods and the prevention of the sale of decayed products came the institution of the various scientific investigations of the subject by the United States Department of Agriculture, by a few technical bureaus associated with State health and food departments, and by investigating and consulting scientists employed by committees representing the cold-storage industry. In addition, various official legislative committees and unofficial commissions conducted hearings and made statistical studies of both the hygienic and economic aspects of the subject. The reports which have been issued as the result of these types of investigations have begun to have their proper effect and the public are now in a state of mind to properly appreciate well planned scientific instruction on the subject.

It is not within the scope of this paper to consider in detail the economic aspects of the refrigeration of foods. Speaking very generally, if the application of artificial refrigeration has preserved for the use of man foods which would have been otherwise returned to the earth or to the sea merely as the products of decomposition, then at least the differences between the values of foods and fertilizers have been saved to humanity. Dr. Pennington has recently stated that one-tenth of the annual egg crop of the United States was wasted by decay at an expense of $50,000,000 a year.

If now it can be shown by investigation that the financial savings through cold storage are not properly distributed among producers, distributors, and consumers, then the problem is one of political economics, but is in no sense hygienic. It is always amusing to the hygienist, if not something more serious, to watch the labored efforts of the untrained or lazy economists to bring to the support of some pet theory supposedly applicable data concerning insanitary conditions or faulty hygiene. While social economics and hygiene have much in common they are in many respects entirely separable. In considering the results of the refrigeration of foods they should be divorced absolutely. Defective sanitation of foods may be faulty economics, but faulty finance does not mean food decay. Food preserved from decay is energy saved for human activity, no matter how faulty the distribution of the savings.

The hygienic aspects of refrigeration group themselves around two main points. The first relates to the preservation of the food, or of the nutritive values of the products so treated. The second concerns the production of toxic substances in the foods so preserved or their contamination by undesirable or disease-producing bacteria.

We would do well to again differentiate in the consideration of the results of storage and not permit our view to be cloudy with pictures of disease and death when only a slight loss of food value is concerned. The latter may be unavoidable by any method of preservation, but the former must be avoided at all hazards.

Let us consider briefly the results of the application of the various types of refrigeration in the prevention or the restraint of the otherwise progressive deterioration in the nutritive value of foods.

The most extensive scientific investigations of this branch of the subject have been made in this country by Richardson upon beef and the flesh of other food mammals; by Wiley, and especially Pennington, and their associates, upon poultry and eggs; by Gies and Pease upon fish; by Rogers and his associates upon butter; by a whole host of workers upon cheese of various types; and by Powell and associates upon fruits and vegetables.

The scope of the work of these investigators has been, up to the present, largely the determination of any changes in the character of the foods mentioned by the application of those tests of the human senses of sight, smell, touch, and taste. These have been called organoleptic tests. In some instances these tests have been supplemented, not only by studies, chemical in character, as to the nature of the changes which may have taken place in the food constituents, but also by examinations of a histological nature to determine any changes in the microscopic appearance of the food products, and, further, by bacteriological studies to show the number of bacteria, if any, present in the foods, from which might be inferred whether any changes found were due to microbic development during storage.

The literature fails to show the results of studies as to the comparative nutritive values of fresh and refrigerated products by well-controlled feeding experiments upon human beings. While it may be warranted, for present practical purposes, to assume that a failure to discover marked organoleptic, chemical, bacteriological, or histological changes in foods, as a result of refrigeration for various periods, indicates a continuance of the original nutritive value of such foods, the question will not be finally settled to the complete satisfaction of the public until well-planned and supervised feeding tests upon man have been undertaken and completed.

The second group of investigations, relating to the possibility of the creation of toxic decomposition products as a result of the cold storage of foods, or to the contamination of the latter by undesirable or disease-producing bacteria, have likewise not been very broad in scope. Sanitary inspections of food-producing or manufacturing plants have not been frequent in this country, and until the last year or two but few have been made of cold-storage plants. Inspections of the latter have been chiefly the work of Pennington and Stiles, of the Federal Bureau of Chemistry, and have been in the poultry, egg, and ice-cream industries. Inspections have been supplemented by bacteriological investigations by the workers quoted for the poultry and egg industries, and by Pease for the cold-storage fish industry. Chemical studies for the detection of toxic substances in cold-stored foods have been made by Boos and Gies upon poultry, and by Gies upon fish.

In considering the results of the investigations mentioned it is of the utmost importance to differentiate between the results of two types of refrigeration processes, namely, simple chilling and the varying degrees of hard freezing.

Under the average simple chill-room conditions, in which temperatures at or above 0° C. are employed, it is obvious that changes of deterioration may take place in given time periods which would not be possible with the application of temperatures below the point of crystallization of the watery constituents in food products into ice.

Simple refrigeration merely brings about heat abstraction, while hard freezing produces in addition actual desiccation and the concentration of the soluble salts in the food, and both drying and salting are well known food-preservation processes.

In simple refrigeration the earlier the application and the greater the degree of heat abstraction the greater the restraint of the process of deterioration of the food.

The scientific investigations mentioned have in every instance shown that the most important point is the early application of the refrigerating process before any changes have taken place in the food. The process is one of prevention of deterioration only. There is nothing curative in it. Where simple refrigeration appears to fail we usually find defective conditions of the food prior to storage.

As to just what the condition should be prior to storage each type of food is a law unto itself. Those possessing animal heat should be given special treatment for its removal, but in general the important point is the condition of normality of the product at the time of application of the heat abstraction process. The nearer the normal the better, because the rate of deterioration under given conditions is not uniform from the start to the end of the process. Beginning slowly, as a rule, it becomes accelerated as it progresses and only slows up when it approaches the maximum point of destruction which the given conditions will produce. To prevent decay before it begins is easy, but to restrain it when it is accelerating is far harder and requires refrigeration at progressively lower temperatures in proportion as the application of the process is delayed.

Simple refrigeration has but slight adaptability as a part of a sound and practical system of food production and distribution unless the foods are in the best possible conditions of normality at the time of its application. As to periods of storage in simple refrigeration, each food again requires special consideration, but in general this type of cold storage is for more or less temporary application only. In practice time limits are always used, but the controlling factors are the previous condition of the food and its type.

Legal limits in simple refrigeration are not yet warranted, for there exists as yet no method of determining definitely the condition of products on their receipt into storage, and but little scientific work has been done toward demonstrating sound time periods of permissible application of simple refrigeration.

The legal and official criteria for approval or condemnation of food products should always be based upon the condition of the latter at the time of passing judgment. This assumes the ability of inspectors to determine both good and bad conditions in foods, and it is the unanimous opinion of investigators of the subject that cold-storage regulation should be undertaken only as a part of a well-planned and efficiently conducted general system of food inspection and supervision. In fact, it is almost apparent to the inexperienced that if there had been, in the various States of this country, effective systems of supervision over all the various sanitary aspects of the production and distribution of foods, there would never have appeared to be any special and prominent sanitary cold-storage problem.

When we consider the results of the investigations of the second type of refrigeration, namely, hard freezing, or freezer storage, we find practically unanimity of opinion. Again and again the results of investigations indicate that the conditions of the food at the time of freezing are all important. Only of secondary consideration are the time limits of such storage. In fact, all agree in the main that the next important stage of food handling, after the conditions on entering storage, are the conditions obtaining in the retailing and the household handling of the frozen products. Time periods of freezing are thus relegated to at least a third position.

While deteriorations progressing to a dangerous degree can take place with some foods subjected to simple refrigeration, especially when the foods have been somewhat deteriorated on entering such storage, yet in the case of freezer storage, properly conducted, foods come out of it in practically the same condition as when they entered it. Only in cases where the foods have been in well-advanced conditions of deterioration when entering such storage, do they emerge in a more undesirable condition. It must be remembered that it takes a few hours to reduce the temperature to hard freezing points in masses of foods of considerable size, and that during that time any already beginning deterioration may not be greatly checked, but this again relates to conditions prior to storage—not during it.

Boos, as well as Gies, failed to find toxic chemical products in poultry stored for long periods of time up to several years, and the writer has not found, in his bacteriological investigations, any evidences of bacterial multiplication in foods rapidly hard frozen and so held.

It is true that under some methods of handling hard-frozen foods there is a greater or less degree of drying and a loss of flavor. However, new methods are constantly being applied to remedy these slight difficulties, and under appropriate conditions of packing and handling, with proper regulation of humidities in the storage rooms these troubles are not necessary even at present.

It is needless to state that cold-storage warehouses should be constructed, equipped, and conducted on the most satisfactory sanitary lines. The water supplies should be of excellent quality and ample in amount. The premises and equipment should be planned so as to be easily cleaned, and they should be kept so. Above all, the capacity for the production of refrigeration should be equal to any demands which the size of the storage rooms and the types of food might make. There should be installed registering thermographs and other recording devices, and their use should be compulsory. The records obtained by their use should be open for official inspection.

CONCLUSIONS.

(A) The sanitary aspects of the cold storage of foods are only a part of the same aspects of the production, handling, and distribution of all perishable foods.

(B) With proper, adequate systems of official food supervision and control no very special sanitary consideration need be applied to cold-storage processes as such.

(C) The treatments of foods up to the time of storage and after removal from storage are the determining factors as to the results to be obtained from either type of refrigeration, namely, simple refrigeration and hard freezing.

(D) Time limits in freezer storage have no important hygienic bearing. In simple refrigeration they are more important.

(E) Each food is a law unto itself, and generalizations in regulations are out of place in the present state of our knowledge.

(F) Further investigations should be encouraged by both official and private agencies.

MUNICIPAL SUPERVISION OF FOOD SUPPLIES AND THEIR DISTRIBUTION.

Mosby G. Perrow, M. A., Ph. D., Health Officer, Lynchburg, Va.

Among the problems presented to it for solution the municipal health department has few more urgent or more difficult than the proper handling of foods. With the single exception of milk, the matter has as yet received insufficient attention, but, with the onward move to betterment, can not long escape full consideration.

Visits to almost any city will disclose the fact that, however advanced it may be in the various lines of sanitation, the municipal market, provided that there is one, is an eyesore, a feasting place for flies and oftentimes a harbor for rats. This is a condition to be remedied, but the remedy must be real, and not apparent. It must meet the critical scrutiny of the skilled sanitarian, the lay citizen, the rather suspicious and conservative dealer, and appeal also to the councilmanic body as a financial investment worth while.

In Lynchburg, Va., an attempt has been made to solve the problem in part. A careful study was made of private meat plants, located in different sections of America, and a plan formulated. This plan involves simply the application to the public market of what is utilized in many localities by private corporations. At each butcher's stall is a mechanically refrigerated box for holding meat and refrigerated show-case counters. The meat is thus kept immediately at hand, free from dust and flies, and in dry, cold air, until sold to the consumer.

This may seem to some a small matter, yet the fact that not only keeping meat properly, but of demonstrating how to keep it, is of decided value. It is a continuous object lesson to the people of correct methods and proper sanitation. Instead of breeding, it excludes both flies and rats, and, as a business proposition, I submit the following figures for the first year, which so far is the only full year: Total cost of building and equipment, not counting lot, $62,000; total income, $10,342.51; expenses, $3,580; net income, $6,462.51.

The effect on outside dealers is already marked. Practically every butcher in the city has equipped a plant modeled on the municipal market, and, without exception, is pleased at the economy over old methods, at the increased sales, and at the high state of cleanliness. No law has been passed requiring this; the simple advantages have been so obvious that the dealers have acted of their own volition.

While, as above suggested, milk has received a great deal of attention, scant thought has been given to butter. It would seem that, in our eagerness to get milk beyond suspicion, we have left butter almost without consideration, although butter will harbor bacteria, for example, tubercle bacilli, for weeks. In America, in the average city, butter is supplied largely from farms. These farms would not be permitted to sell milk, but no legal obstacle has so far been interposed against their selling butter. It would not be advisable, at present, to cut off the sale of this butter, and yet there is no question that it is a dangerous substance. The remedy suggested here is to start a creamery. The creamery should be allowed to purchase cream from any farm on condition that the cream is pasteurized. By pasteurizing, the butter will be made safe, and the superiority of the creamery butter will soon displace most of the country butter without the enactment of any law. This is suggested as a practicable way to eliminate one source of infection, and thus to move sanitation forward one more step. At certain places a creamery may not be advisable, but in Lynchburg (we now have two) it has worked admirably, and there is ample reason to believe that many cities could proceed along similar lines. There is no question but that butter is, under existing conditions, a dangerous source of infection; in my judgment a more dangerous source of tuberculosis than milk, and so the creamery project is advanced as a method of relief.

Hygienists everywhere are rightly condemning the common drinking cup. Now, in some places the drinking fountain can not be used instead of the cup or glass, and the sanitarian must try to provide a proper substitute. Such a place is the soda fountain. Of all common drinking vessels the soda-fountain glass is one of the most suspicious. In Lynchburg a suggestion was made to a merchant to use a sterilizer. As a result he has a large hot-air sterilizer, in which all of the glasses are heated for 15 minutes to 170° C. The method has increased his business, is cheap, removes the possibility of infection, and serves as an object lesson to the public. Other merchants have begun preparations to install similar outfits.

If one may be allowed to generalize from the foregoing three examples, I would say that education should always precede law, and if the educating is correctly and thoroughly done the enactment of law frequently becomes almost unnecessary. Most people want to do the right thing; they only need to know, and to be certain that they do know. The health department should see that this information is furnished, and the law that follows will then have to do mainly with the incorrigibles.

FRIDAY AFTERNOON, SEPTEMBER 27, 1912.

THE FUNCTION OF CENTRAL OFFICIAL AGENCIES LOOKING TOWARD THE IMPROVEMENT OF MILK PRODUCTION AND DISTRIBUTION.

B. H. Rawl, Chief of the Dairy Division of the Bureau of Animal Industry,
Washington, D. C.

The central agencies referred to in this subject I understand to mean the agencies of the National Government. It is impossible for me to discuss the part that the National Government should take in connection with the sanitary betterment of production and distribution of milk without alluding briefly to the work of the States and the cities. For this I hope that I shall be pardoned by those who are to discuss the State and city work. Milk inspection is primarily the work of the municipality.

1. Because this system is economical and places the expense of the work where it properly belongs.

2. Because the officers who are responsible for the inspection are in close personal touch with the people who consume the milk and the people who produce it.

3. The cities have all the authority that is needed to do this work, whether the milk is shipped interstate or not; for, while a city can not designate what a dairyman in some other State should do, it can prohibit him from selling milk within its limits unless he complies with the requirements which it provides.

4. There is such a great amount of work to be done in connection with a proper supervision of the milk supply that unless the cities undertake this work for themselves it is probable that the work will never be done.

State officials are in a position to assist the cities in starting this work, and to help them out when emergencies arise. They are in a position, too, to take care of the milk supply in towns, villages, and small cities where there are no local facilities for inspection. In many ways the State and the city officials can work together to the greatest advantage without in the least confusing their responsibilities. The State might establish minimum standards for everybody, but the cities should have the privilege to exceed these standards whenever they can.

So far as I am informed, there is not a State, or even a city, that has adequate inspection; and by adequate inspection I do not allude simply to the number of inspectors, but rather to the character of the work done. A few cities are doing some most excellent work, considering the many difficulties that are being encountered, but there is a general need for much more work in connection with milk control.

But, aside from the inspection work, and the educational and laboratory work incident to it, there is, and perhaps will always be, need of a great deal of research work. There are hundreds of questions to be answered, and new ones are arising constantly. Research must determine, not only what methods are satisfactory from the standpoint of sanitation and hygiene, but it must also solve a large number of economic problems, for it is often the solution of economic problems that makes possible the application of the proper method of sanitation. For example, no health authority, if he could help it, would permit the use of milk from tuberculous cattle; but, before he can help it, the economic question of getting rid of the tuberculous cattle and growing others that are not tuberculous must be solved. In other words, as soon as we begin to apply sanitary requirements, the cost of milk begins to rise, and this rise must be overcome, in part at least, by adjusting some of the economic factors. For another example, let us suppose that it costs a half cent a gallon to ice milk while in transit, and that by a change of system it is possible to save this half cent in the cost of delivery to the consumer, would not the official be much more likely to get the milk iced than if this half cent per gallon were added onto the consumer's price?

The need of a very large amount of research work is imperative, and it is in this line that the Federal Government can be most useful. I do not mean that others should do no research work, for there is need of all that can be done; but in view of the great need for more inspection work, which must in the main be supplied by the cities and States, it is only natural for them to direct their efforts toward inspection rather than research.

Realizing the great lack of knowledge in connection with milk production and distribution, the Dairy Division has been increasing its research work just as rapidly as possible. Its policy has been to employ a group of men indefinitely upon a single problem. For example, three of our men have been working for three years upon the subject of pasteurized milk and other closely related subjects. Extensive studies are being made in this manner of the various methods of cooling, storing, transportation, handling, and the comparative cost of different systems of refrigeration, and now we have begun an extensive study of the cost of production under various conditions. An effort is being made to study thoroughly each operation from the producer to the consumer.

Other divisions of the Bureau of Animal Industry are making extensive investigations relative to the infection of milk from animal and human sources; for example, the discovery of tuberculous infection of milk from animal feces is the result of some of this work.

Then, too, there are the many problems of hygiene that must be solved. In what way does this method or that have a bearing on the health of the consumer? I am not capable to discuss the work in this line that is being done by the hygienic laboratories of the Federal Government; but it will doubtless be presented by others.

There is another line of work that the Dairy Division has been doing for several years that has been fruitful. When some good method is developed in Massachusetts, for example, it might require a long time for that method to reach Minnesota or Oregon; but our field men, who are lending a helping hand here and there in connection with the work of educating the producer and consumer, are able to collect all new methods that have proved good and to take them to other States. This work has been done largely in cooperation with city officials, because they have sought the work more than the State officials have. We would like, however, to do what we can to encourage the State departments to give the cities the assistance that we are so frequently called upon to give, and then we might be able to lend a helping hand to the States in their work of helping the cities. As the city and State inspection systems become more and more complete there may be less need of this work by the Federal Government than at present, but so far we have been unable to grant all the requests for it that have been received.

A complete system for dealing with the question of the milk production and distribution of the whole country should employ the facilities of the city, the State, and the Nation. The city is the unit of operations, and around it should be developed the organization designed to do the bulk of the detailed work. The State should help the cities to organize their work, assist them in case of emergency, and be responsible for the milk supply of the smaller towns and villages. The National Government should largely supply the research work and serve as a medium between the States.

There are two main problems in connection with our milk question. One is to obtain new knowledge and the other is to teach the people. At present we have more knowledge already than is actually applied, but this is a normal condition which will always exist; and, notwithstanding this, we are woefully ignorant of the whole subject of milk, for any fool can ask questions concerning it that no one can answer.

When it comes to the educational side of the work there is no end to our needs. The producers must be taught, the dealers must be taught, and the consumers must be taught. But who is available to do all of this teaching? Is it the milk inspector? Yes. But he is often a political appointee and knows nothing about the question himself. Then we would better arrange to teach him or else secure the services of an inspector who will not need to be taught, for it is the milk inspector, the man who comes into personal contact with the producers and distributors, who must establish the methods which will make a supply of safe milk both possible and sure.

All of the work now in progress that relates to the production and distribution of milk is but small in comparison with the importance of the subject. Our aim, therefore, should be to so harmonize all of our work that it will accomplish the greatest good.

THE FUNCTION OF THE STATE IN MILK-CONTROL WORK.

H. L. Russell, Dean, College of Agriculture, Madison, Wis.

The importance of the matter of milk control is such that it must occupy the attention of governmental authorities as well as that of the individual. As with all matters relating to health, the problem must of necessity be an individual one, but the public aspect of such a problem is so dominant that collective action should be required. Undoubtedly, in the development of this phase of the work, the first correlating unit should be the municipality and not the State, as the problem is so intimately and vitally associated with the daily life of the community. But there are certain things which should be done that the municipality can not legally or effectively accomplish and there are other problems that the State can accomplish much more readily and thoroughly. This fact forces the consideration of a State-wide aspect as well as that of the community. Indeed, the Nation itself can not wholly ignore its duty in a matter of such vital concern to the well-being of its citizens.

The regulative powers of the municipality can not legally extend beyond its borders. Almost without exception, the milk supply of any town, even though small in size, of necessity originates outside of the community which is served. Naturally, under these conditions, the police power of the municipality can not reach the vital spot in the milk problem, namely, the place of production, except in an indirect manner. The city, through its power to license for the privilege of doing business within its borders, can, in a considerable measure, exercise supervision over production. It can say to the producer that the quality of the product sold to its citizens shall conform to such and such standards, and, if the product does not conform to such requirements, it can debar the sale of the product.

In the determination of such quality municipalities have gone further than ascertaining the condition of the milk at time of sale. Through the appointment of county inspectors, attempts are made to control the manner of production. Such supervision, however, does not have mandatory powers, because it is not effective until the product is offered for sale within the jurisdiction of the municipality. It is here that the function of the State begins.

Manifestly, the work which the State can most effectively accomplish is in two directions: First, educational; second, supervisory, through its police powers.

Of course, the educational propaganda is a problem in which the municipality, the State, and the Nation can all correlate their activities. The State is, on the whole, in better position to push this work actively than the Federal Government. Theoretically, we might also say that the community is in better position than the Commonwealth to carry on this propaganda effectively, but in practice this is rarely found to be the case, except in the larger cities. The nearer the problem can be brought to the people the more concrete it becomes, but it is a foregone conclusion that effective educational work requires the stimulus which comes from an especially interested individual or organization before much can be accomplished.

The energetic city health official, with the close personal touch he can give the problem and with the intimate relation he can secure from the public press, is in position to accomplish much good, but rarely does a city of less than 25,000 to 50,000 population have, as guardian of the public health, a person who is so situated as to give sufficient time to this aspect of his work to accomplish the desired result. If the work devolves actively upon the local health official, educational data must be worked up from the beginning by each city official who undertakes the problem. Under such conditions one city with an aggressive health official will carry on an active campaign, but the necessary propaganda may not be started in the neighboring city, because possibly the appointed official lacks interest or initiative.

If the educational work is fostered by the State the movement can be put on a wide enough basis so as to receive, if necessary, the entire attention of a specially deputized official. The data prepared are largely applicable in one city as well as in another. By means of traveling exhibits the importance of pure milk can be brought forcibly and effectively before different communities. In the carrying on of the State campaign the local press is an invaluable agent in arousing interest and enthusiasm. The work which has been accomplished by the State antituberculosis organizations in their exhibitions in different cities shows the possibility of a properly organized propaganda.

In this educational propaganda there are two widely different groups on which effort must be spent—the producer as well as the consumer. The State can legally and effectively reach both; the community only the latter.

The problem, in its sanitary relations, is still further complicated through the fact that attention must be paid, not only to diseases that are capable of dissemination in both man and beast, but also to those induced by pollution subsequent to the withdrawal of the milk from the animal. It is necessary to exclude from the milk supplies the tubercle organism which, even from bovine sources, finds in children a suitable foundation for its development, but it is more necessary (when judged by the relative mortality) to see that milk is so handled that it is not contaminated with those organisms which are able to produce disorders in the infant and the young child.

The tuberculosis problem can be effectively reached only by State control. While, of course, it is impossible to institute comparisons along economic and sanitary lines, it is nevertheless true that greater headway is now being made in the control of this disease in those sections where the economic aspect of bovine tuberculosis has been especially emphasized. The prevalence of this disease in our herds, particularly dairy herds, and its extreme insidiousness, have led the farmers to embrace the opportunity to determine the actual condition of their herds quite as much from the economic point of view as anything else. Where compulsory legislation based purely on a hygienic foundation has been had, the response on the part of the producer has been forced, and, more frequently than otherwise, has been perfunctory, if at all. In this campaign the public post-mortem demonstration held in the country districts under State control has been found to be a most effective educational agent.

One problem which so far has not received the attention which it should is the correlation of the work which should be performed by the State. At present three generally unrelated State organizations may be concerned with the milk problem:

(1) State boards of health, which are directly interested in public health problems.

(2) State live-stock sanitary boards, or live-stock commissions, which are concerned with the control of animal diseases.

(3) State dairy and food commissions, which control the purity and wholesomeness of food supplies.

Too frequently there is no correlation in the work of these respective bodies. The milk problem touches all three of them, but with none of them is it a dominant phase of their activity. The consequence is that the problem in its entirety does not receive the adequate attention of any of them. In this respect improved conditions would undoubtedly obtain if a more thorough correlation of these various organizations could be brought about.

The milk problem, as such, is properly a hygienic matter. Under these conditions, there is no question but that the public health organization is in better position to exercise more effective control than either of the other two.

The labors of the voluntary organizations, such as the milk commissions of various scientific bodies, have done much to formulate ideas that are applicable to conditions that obtain in our larger cities. But their work must, after all, consist largely in education, rather than in actual control. Through the official State organizations must come the legal safeguards that the public desire to be drawn about the matter of milk control.

THE SANITARY CONTROL OF LOCAL MILK SUPPLIES THROUGH LOCAL OFFICIAL AGENCIES.

ERNST J. LEDERLE, Ph. D., Commissioner of Health, City of New York.

In discussing this subject there are several reasons for speaking largely from the point of view of milk inspection in New York City. In the first place, my own experience in this field has been gained almost entirely through a connection of 20 years, in one capacity or another, with the local department of health. But of greater importance is the fact that the experience of New York City in the control of its milk supply, both historically and in the light of important recent developments, is, I believe, full of significance to other municipalities and particularly to large cities facing similar problems. I trust, then, that my references to the work in our city may contribute in a small degree to the discussion of the general subject in which we are interested.

It will perhaps be generally recognized by those interested in the administrative control of the production and sale of milk that New York City offers a most conspicuous example of a municipality undertaking practically the entire supervision of its own milk supply all the way from the cow to the consumer. Most large cities doubtless exercise more or less jurisdiction over the sale of milk within their limits, but no other city that I know of has developed such an extensive system of inspection of dairies and creameries as is practiced by the city of New York, notwithstanding that nearly all the 45,000 farms on which our milk supply is produced are located outside the city limits, and more than 6,000 of them outside the State of New York.

The board of health has power to adopt a sanitary code, without the concurring vote of any other municipal authority, and this code has the full force and effect of law in New York City, so long as its provisions are consistent with general State laws. The existing system of public control of New York's milk supply is based upon the sanitary legislation of the board of health, in the form of appropriate sections of the sanitary code, and supplementary rules and regulations.

Let us now consider briefly some of the facts that have made the sanitary control of milk supplies one of the most important public health problems of our communities.

INFANT PROBLEM.

Milk suitable for infant feeding must comply with the following requirements:

It must have the proper nutritive value; that is, it must not be impoverished by the removal of a portion or all of its fat, or the nutritive value lowered by the addition of water. It must be clean. In general, it is agreed that the bacterial content of milk is an accurate scientific index of its cleanliness, but it is comparatively recently that the danger of bacterial contamination of milk has been appreciated. It has been found that infants under one year are very susceptible to poisoning by milk infected with excessive bacterial growth, particularly during the hot season, when the resistance of the digestive tract is lowered.

Milk infected with the germ of bovine tuberculosis may transmit tuberculosis to children, but is not apt to infect adults, while milk carrying the germs of typhoid fever, scarlet fever, diphtheria, and tonsilitis is dangerous to persons of all ages.

INFECTIOUS DISEASES AND MILK.

Tuberculosis, typhoid fever, scarlet fever, diphtheria, and tonsilitis are the principal diseases which in this country are transmitted by means of infected milk. It is believed that the tubercle bacilli are in the majority of cases derived from the cow, but they may come from human sources. Typhoid bacilli in milk are always derived from man. The contagion of true scarlet fever transmitted through milk is considered as always coming from man, but there is a disease closely allied to it, the contagion of which is derived from the cow. Diphtheria bacilli are regarded as being always of human origin.

The streptococci exciting tonsilitis are believed to be derived both from cases of septic inflammation of the udder and from human sources. Acording to Park, about 3 per cent of all tuberculosis existing in New York City exhibits the bovine type of bacilli, and is therefore probably caused by milk infection. Of 279 cases of tuberculosis in adults examined by him, only one case was due to the bovine type. On the other hand, 22 out of 84 very young children and infants examined, or about 24 per cent, were infected with the bovine type.

TYPHOID FEVER AND MILK.

During the last two years, through special investigations carried on by the New York City Department of Health, much light has been thrown upon the definite origin of outbreaks of typhoid fever due to milk infection. Several such outbreaks were traced definitely to so-called " carriers," or persons who have recovered from an attack of typhoid fever, but who remain infected and continue to excrete typhoid bacilli. One outbreak of 400 cases was traced to infection of a milk supply by a typhoid carrier who had had the disease 47 years ago. In another, 50 cases were traced to a man who had had the disease 7 years ago. These important new discoveries led the department to strongly urge the necessity of the pasteurization of all milk except that produced under special stringent conditions.

PUBLIC PROTECTION OF MILK SUPPLIES.

In view of these sources of danger to the public health, what means can be employed to make public milk supplies safe?

The problem involves three distinct features:

(1) The prevention of adulteration, either by the addition of water, the removal of fats, or both, and the exclusion of all preservatives and, in fact, all foreign substances.

(2) The production of a clean milk, a milk low in bacteria, involving great care from the time of milking to actual consumption. This involves effort to insure the cleanliness of the cows and the milkers, properly constructed, clean barns, proper and thorough cleaning of the vessels and utensils with which the milk comes in contact, exclusion of dust at every stage, immediate reduction of temperature of milk after milking, thorough icing during transportation, the sale under sanitary conditions in stores, and, finally, proper care in the hands of the consumer.

(3) The production of a milk free from pathogenic organisms, requiring, first of all, healthy animals, and, subsequently, the careful handling of the milk at all stages to prevent the introduction, by human agencies, flies, and dust, of the germs of infectious disease.

METHODS OF PUBLIC CONTROL.

The general outlines of the methods adopted by boards of health and other governmental authorities in controlling the sanitary quality of milk supplies of cities are fairly well defined and generally accepted. It is recognized that a system of inspections of dairies where the milk is actually produced, supplemented by inspections of creameries and of the methods of shipment and handling all the way from the farmer to the consumer, are necessary elements of this public control. Such inspection must provide for the detection of contagious diseases among those handling the milk, as well as for the improvement of sanitary conditions.

Whether these details are carried out under the supervision of municipal or State authorities is a matter of expediency largely governed by local conditions. Theoretically, it would be better that State authorities should exercise a uniform control over the production and sale of milk in all communities. In practice some of our large cities have found it necessary, in the absence of thoroughgoing State control, to develop their own system of milk inspection in the country as well as in the city.

The control of conditions under which milk is handled and sold within the city is a still more usual function of the local authorities, and includes the regular inspection of stores and wagons, with frequent chemical and bacteriological tests, and, if necessary, the usual method of enforcing sanitary requirements by resort to the courts.

THE NEW YORK PLAN.

More particular reference to the present system of milk inspection by the Department of Health of New York City and of the methods now in use will perhaps illustrate certain phases of our general subject. I may say here that, for the information of members of the congress who are especially interested in this subject and in the experience of New York City, the department has had prepared a special bulletin dealing much more fully with the details of our work than I shall be able to do within the present limits.

The magnitude of the problem which New York faces may be imagined, when it is considered that the city draws its daily milk supply of 2,500,000 quarts from 44,000 farms located in six different States, namely, New York, New Jersey, Pennsylvania, Connecticut, Vermont, and Massachusetts. Some cream is also received from Ohio and Canada. The "milk shed" covers an area of 50,000 square miles. The milk is produced from approximately 350,000 cows, and shipped from 1,100 creamers over 11 different railroads, the shortest haul being 50 miles, and the longest, 425 miles. When it reaches the city, it is received at 15 different terminals, and eventually delivered in 5,500 wagons, and dispensed at 14,000 stores. It is estimated that about 127,000 persons are daily engaged in handling the city's milk supply, and, on the basis of the relative frequency of typhoid bacillus carriers in the population of New York City, there may perhaps be a hundred such persons included in this army of milk handlers.

Milk inspection began in New York in the late seventies and early eighties, and this inspection work was conducted in cooperation with the State officials of New York and New Jersey. Then, however, the elementary forms of adulteration, consisting in the removal of cream and the addition of water, were the only points considered. Later, it developed that a knowledge of the bacteriological content of milk was of much greater importance, so far as the public health was concerned, than was its chemical composition. When it was found that the bacterial content of milk was an accurate index of the cleanliness of the methods used in its production, attention was more and more directed to the supervision of conditions at the farm, at the shipping stations, and on the railroads. This work was continued in 1906, and it was then realized that successful control would never result until the milk was traced back to its very source. This was the beginning of actual dairy inspection by the New York Department of Health. From two inspectors in 1904, the number has gradually risen until there are now 56 milk inspectors, of whom approximately one-half are assigned to the country district, and one-half to the inspection of stores, wagons, and other premises within the city.

LEGAL ASPECTS OF THE NEW YORK PLAN.

It was under the administration of my predecessor, Dr. Darlington, that inspection of milk in the country districts was first established. Perhaps one of the most interesting phases of this work is the legal basis upon which the authority of the department is exercised throughout an area covering portions of six different States. The sanitary code requires that no milk shall be sold in the city of New York without a permit from the board of health, and the board maintains that it is entitled to ascertain the conditions under which milk is produced, before issuing a permit to the dealer who buys that particular milk and brings it to the city. Under the operation of this system, it is rare that permission to inspect a dairy or creamery is refused. When such refusal is met with, the department notifies the dealer, who then faces the alternative of refusing to receive milk from the particular farm or creamery under criticism, or of having his permit to sell milk in the city revoked. The result, of course, is very salutary in excluding from New York City all milk from farms which do not meet the requirements. The question may be raised as to what protection other communities receive under this plan, since the producers whose milk is excluded from New York City doubtless find a market elsewhere. This exhibits the great defect of local control of milk supplies. It is undoubtedly far better that the State should undertake the control of milk production under adequate and uniform standards rigidly enforced by a sufficient number of inspectors throughout the State. New York State has an excellent department of agriculture, and adequate laws governing the production of milk, but the appropriations made by the State for this work are totally inadequate to insure the character of the supervision of dairy farms which the city of New York believes to be necessary to the purity and wholesomeness of its milk supply. Even if State supervision in New York were sufficient, a similar question remains in the case of the six other States from which the city's milk is drawn. With these varying jurisdictions, the city has been obliged to face actual conditions, instead of legal or constitutional theories, and to evolve its own system of supervising the milk at every stage from the dairy to the breakfast table.

As may well be imagined, the attempt of New York City to exercise authority over the milk production of other States was not allowed to go unchallenged, and the whole question was carried through the courts, in appeal after appeal, until finally the Supreme Court of the United States, in an unanimous opinion, affirmed that the position of the city of New York was reasonable, valid, and not unconstitutional. Those who care to read the text of this decision in full will find it reported elsewhere.[1] In its decision the Supreme Court stated that any State has a right, by reason of regulations, to protect the public health and safety, and that the Supreme Court "will not interfere because the States have seen fit to give administrative discretion to local boards to grant or withhold licenses or permits to carry on trades or occupations, or perform acts which are properly the subject of regulation in the exercise of the reserved power of the State to protect the health and safety of its people." Here, then, we have the support of the highest court in the land behind our effort to procure proper sanitary control of our local milk supply, and here, perhaps, this paper might very properly end were it not that I feel compelled to take advantage of this favorable occasion to refer very briefly to the developments of this problem in New York during the past two years, the more so as the problem we have attempted to solve will be encountered in a greater or less degree in the attempt to protect the milk supply of any city.

DEFICIENCIES IN LOCAL MILK INSPECTION AND RECENT IMPROVEMENTS.

For several years we have felt that our methods of controlling the milk supply were inadequate and did not accomplish the desired results, particularly in the following respects:

It is now a well-known fact that the general milk supply of every large city in the world is unfit for use in infant feeding. Two well-defined methods have been applied in New York to effect a change in this respect; firstly, the production of a special grade of milk, "certified" and allied grades, for infants; and secondly, the general movement to improve the whole supply, so that milk suitable for infants might be procured everywhere where milk is sold. Each of these methods has been successful to only a very limited extent. After 10 years less than 1 per cent of the city's milk is of the certified type, or equivalent thereto, and the expense of this class of milk for general use in infant feeding is almost prohibitive. In fact, it is a luxury within reach of comparatively few. What is needed is a safe milk which can be furnished at a price within the means of the masses.

The attempt to bring general market milk to the degree of purity required for infant feeding can never be successful in a large city. In the first place, it is economically not feasible, since too great a part of the total supply of milk is used for other purposes, for adults, who do not require a milk of such special requirements, and for cooking purposes, where a still less degree of bacteriological cleanliness is necessary. It naturally follows that milk for the last two mentioned purposes can be produced and sold at lower prices than special infants' milk. In the second place, although the system of surveillance has materially lessened the danger of infection of milk from the presence of cases of infectious diseases among the employees on the farms and in the creameries, or from unhealthy animals, our present knowledge of the propagation of typhoid fever by milk infected by "typhoid carriers," and the fact that tuberculosis is so widespread among our dairy herds, have forced us to the conclusion that, no matter how complete or well organized the system of dairy inspection, it will not be possible to render entirely safe the ordinary commercial milk which is produced and shipped to a city from so large a territory as is comprised in the New York City milk field.

In our opinion, the only way in which the sanitary authorities can meet these conditions is by requiring the pasteurization at least of all milk that is not of special exempted grades. We have always been impressed with the necessity of dealing separately with the problem of milk to be used for infants. Since the requirements for infants' milk are so much more exacting, and since it has been well established that this grade of milk is much more expensive to produce, and should command a higher price than can ordinarily be demanded for milk in general use, it was deemed wise to separate the two problems.

As early as October, 1907, in an address given at Milwaukee, I took the position that the sanitary authorities should establish a system of grading our milk supplies, and that, in the interest of public health, practically universal pasteurization must be insisted on. Since January, 1910, the development of such a milk program has been one of the foremost subjects under consideration by the department of health. Early in January, 1912, on my recommendation, the Board of Health of the City of New York officially adopted the following plan of grading and labeling all milk brought into the city and sold there:

GRADE A, FOR INFANTS AND CHILDREN.

1. *Certified milk*, milk certified by a milk commission appointed by the medical society of the county of New York or of the county of Kings as being produced under the supervision and in conformity with the requirements of that commission.

2. *Guaranteed milk*, produced under the same standards as certified milk, but under the supervision of the board of health.

3. *Inspected milk*, *raw*.—This milk must come from tuberculin-tested cows. Farms must obtain in an official score at least 75 points, with a minimum of 25 points for equipment and 50 points for method. The milk must not contain more than an average of 60,000 bacteria per cubic centimeter when delivered to the consumer.

4. *Selected milk*, *pasteurized*.—Farms must obtain at least 60 points in official score; 20, at least, for equipment, and at least 40 for method. The milk must be pasteurized as prescribed by the rules and regulations of the department, which, of course, provide for such temperatures and times of exposure to heat as have been shown by our own researches to be necessary to render the milk thoroughly safe. This milk must not contain over 50,000 bacteria per cubic centimeter when delivered to the consumer, and must be delivered in bottles, except on special permit in certain cases. Containers must be labeled "pasteurized," and the label must bear date and hour when pasteurization was completed, the place where it was performed, and the name of persons or corporation performing it. The milk must be delivered to the consumer within 30 hours after pasteurization. Milk to be pasteurized must not contain over 200,000 bacteria per cubic centimeter.

GRADE B, FOR ADULTS.

1. *Selected milk*, *raw*, from cows which are certified as healthy by veterinarians after physical examination. Farms must score at least 68 points, 25 for equipment, and a minimum of 43 for method.

2. *Pasteurized milk*.—This milk must be delivered within 36 hours after pasteurization.

GRADE C.

This grade is to be used for cooking and manufacturing purposes only, and includes all raw milk not conforming to the requirements of grades A and B.

The full details of the new rules and regulations will be found in the special bulletin already mentioned. The department is now actively enforcing the new requirements, and, in our opinion, the adoption and enforcement of the plan marks the greatest advance ever made in the public sanitary control of New York City's milk supply. I will indicate briefly what it is expected that this plan of grading and labeling will accomplish:

FOR THE FARMER.

It means, in effect, that farms will be scored, and a farmer will know what grade of milk he is producing, and how he can produce a better grade, if he so desire. The better grades of milk will command a higher price at the farm; therefore, for the first time in the history of milk production, an incentive will be given the farmer to produce a cleaner milk. This principle, of course, was established on a very small scale in the production of certified milk, but never before in production of milk for the masses. There is an apparent contradiction of this principle in the case of pasteurized milk, in which case, under the present condition, a supply of milk, of the cooking grade (C) may be brought into the higher grade (B) by pasteurization, without any material improvement of farm conditions. The advantage to the general public health of pasteurization is, however, so great that it was thought wise to encourage pasteurization to the fullest extent possible, without making too many restrictions at this time, but, when finally worked out, the general requirements for all milk, with the exception of that for cooking, will have to be further advanced so that there will be no setback in the movement for a cleaner milk supply, the fear of which condition has led so many persons to oppose the introduction of pasteurization.

FOR THE DEALER.

The grading and proper labeling regulations will be a great incentive to the progressive and honest dealer who is willing and anxious to sell his products on a proper basis, and who by this plan will be aided in his efforts by official control. It will no longer be possible for the dishonest dealer to market the lowest grade of milk under false representations, or to sell cooking milk for infants. Those dealing only in the lowest grade—cooking milk—will have to sell the same as such, or go out of business.

FOR THE PUBLIC.

The users of milk will be enabled to purchase the quality of milk they require and for which they can afford to pay. This is particularly important in the case of milk for infants and children. For those who can not afford to purchase the special qualities in grade A offered for this purpose, specific instructions will be given showing under what conditions grade B may be used, and, in the case of the poorer classes, provisions have been made by the municipal authorities, through the infant's milk stations of the department of health (at present 55 in number, located in various parts of the city), to supply milk for infants' use at a moderate cost, and without charge, in certain special cases, through the charitable agencies operating in conjunction with the department.

The plan carries with it the establishment of the broad principle that the milk sold from cans ("dipped" or "loose" milk) in the grocery store is unfit for use for infants.

The special requirements made for the production of raw milk (grade B), its limitations to use by adults, and the recommendation that pasteurized milk of the same grade is a safer milk, will encourage the extension of pasteurization, as it was intended to do.

We feel that the time has come when just as radical changes as have been inaugurated in the requirements for the grading and labeling of milk, will have to be applied to the regulations for the sale of milk in stores. The situation is peculiar. Milk is sold in about 20,000 places. Every little corner grocer sells milk, not because there is any direct profit to be derived therefrom, but as a convenience to the customer who desires to purchase other commodities. There is, therefore, no incentive to the proper care of the milk. It must be understood that almost all of such milk is dipped from cans. No permanent reform can be inaugurated until the sale of this class of milk is limited to milk stores where other commodities are not permitted.

INFANTS' MILK STATIONS.

I have already referred to the 55 municipal stations for dispensing milk for babies which are now in operation under the administration of the department of health. This work was begun in 1911, when an appropriation was made for 15 experimental stations. A large number of depots were also conducted by private organizations, and the work was so successful that this year the city made provision for the larger number. I believe, however, that this work is only in the developmental phase, and that the ultimate solution of the infants' milk problem must and will be found in the production of the special grades of milk suitable for infant feeding, and the placing of this milk on the general market, so that it will be easily possible for mothers to obtain milk of the proper quality at reasonable prices in milk stores or from dealers. In that event, the municipal and other milk stations for infants will doubtless gradually assume what I take to be their proper function of serving as centers for the education of mothers in the care and feeding of babies and in the care of milk in the home.

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[1] 199 U. S., 552; 81 App. Div., 128; 175 N. Y., 440.

THE WORK OF MEDICAL MILK COMMISSIONS IN THE CAMPAIGN FOR THE BETTERMENT OF MILK PRODUCTION AND DISTRIBUTION.

Henry L. Coit, M. D., Newark, N. J.

In the year 1890 an attempt was made by the medical profession to obtain legislation on the purity of the milk supply in the State of New Jersey.

This object, important alike to clinicians and to those who study the economic relations of infant mortality, it was then impossible to attain.

This was the first purely professional effort made in the United States to secure suitable milk for clinical purposes; it preceded by four years the first official control over the milk supply, which was established in Washington in 1894.

This agitation, started in the Medical Society of New Jersey, has become a world-wide movement, and, because of the widespread morbidity and mortality due to milk, physicians have become insistent in their demand for clinically clean milk.

The Medical Milk Commission had its inception in the efforts of the author of the plan to solve problems in infant feeding. It was coincident with the early work in the United States on the artificial nutrition of infants; and this particular need for clean milk is to-day the largest single factor in sustaining the interest in the subject.

DEFECTS OF ORDINARY METHODS OF MILK PRODUCTION.

Every ordinary method thus far employed for producing and distributing milk on a large scale reveals defects and can not be trusted to yield a product suitable for the use of the sick, for hospitals, or for the food of the young infant. Gathered milk, so called, constitutes the larger portion of milk brought to the cities. This is often milk of low grade, and, in many places, needs only to pass the casual view of the inspector at the railroad station to fulfill municipal regulations.

Legislation has heretofore been trusted to regulate this matter, but neither Federal legislation nor the ordinances of municipal government can secure what we require. These influences are too remote from the sources of supply; their demands are too limited; their standards of purity too low; they are not closely identified with the actual dairy work, and do not stimulate the best efforts of the dairymen in the practice of dairy hygiene.

Furthermore, it will probably always be true that legislation can not regulate the details of special kinds of work; an ordinance, in its letter, may require milk to be clean, but how it shall be made clean it can not define. Law may fix a standard of cleanliness and purity, but it can not determine methods for its attainment; it would be necessary that the code should define what constitutes a clean hand, a clean udder, a clean vessel, a sterile container; what constitutes a healthy animal, a safe workman, good food, or proper housing and care. These the law never has determined, and probably never will determine.

POSSIBLE METHODS OF CONTROL.

There are three methods of supervision of the milk supply now employed to safeguard its purity: First. Commercial control, which is followed in many cities. There is perhaps a license issued to collectors and distributors of milk, but there is no proper or efficient official inspection of the dairy premises or milk shops; most of the supply is brought on railroads from distant points and without proper refrigeration. The method is imperfect, and great havoc is wrought among the people through infection and infant morbidity and mortality.

Second. Municipal control, which involves official inspection of farms and supervision of transportation and of milk shops. In this the score card has recently been employed. New York City, with its comprehensive milk regulations, uses this method. In every large city the control of by far the greater part of the milk supply must fall on the health department; therefore, very great importance must be attached to any good system for the control of market milk. New York City consumes daily nearly 2,000,000 quarts of milk, distributed from 12,000 milk shops and obtained from 30,000 sources of supply.

Third. Medical supervision and control. This method does not supersede the foregoing official or municipal control which is employed in cities for the general supply, but it attempts to obtain a special or clinical milk, suitable for the sick, for hospitals, and for young infants. In quality this product is so far above the requirements of the municipal ordinance that it is not strictly under the law at all. The plan provides for the voluntary unpaid services of a commission of physicians, appointed by a medical society, and combines under its control a dairyman, a chemist, a bacteriologist, a veterinarian, and a medical inspector of employees, who render to the commission information, following which, if its requirements and standards are met, the commission issues a certificate to the dairyman which permits him to designate his product "certified milk." The method includes: (*a*) Contract control of production; (*b*) automatic advance of requirements with increased knowledge; (*c*) safeguards, including the most advanced methods of sanitary science.

CLINICAL STANDARDS OF PURITY FOR MILK.

In order to meet the clinical requirements for milk in the present state of our knowledge, three conditions of purity must be fulfilled. These requirements were formulated in 1892 in connection with the organization of the plan for medical control:

First. An absence of large numbers of microorganisms and the entire freedom of the milk from pathogenic varieties.

Second. Unvarying resistance to early fermentative changes in the milk so that it may be kept under ordinary conditions without extraordinary care.

Third. A constant nutritive value of known chemical composition, with a uniform relation between the percentages of its combined constituents and its organic principles, unimpaired by mechanical, thermic, or chemical treatment.

THE PLAN.

When we look back over almost a lifetime at the condition of milk in the eighties we find that it was one of the most uncultivated fields in sanitary and prophylactic science.

Everyone who had to do with the production of milk or with the use of milk was a law unto himself. Those who produced it had only commercial purposes in view, and those who used it had little knowledge of its vital relations to health or its causative relations to disease; and the altruism of its use by philanthropy for the prevention of infant mortality was never dreamed of.

In 1888, through the necessity growing out of a personal need for clean milk in the feeding of infants and young children, it was discovered that the milk conditions in large cities everywhere were inimical to health and safety, and that legislation could not be depended upon to afford relief. Municipal health departments had not yet realized their duty toward the public in this matter. It was the realization of the fact that clean milk was one of the most urgent fundamental questions presented for public and professional consideration that the speaker was led to ask for its investigation by the Medical Society of New Jersey in 1889.

After two years' study of the problem a committee of 42 physicians concluded that as a public, economic, and medical question it was of sufficient importance to engage the influence and cooperation of the entire medical profession.

A legislative committee was asked for and appointed, and after several months of effort through the State departments controlling health, agriculture, and food, legislation as a means of relief was for the time being abandoned, and the speaker formulated a plan by which it was sought to obtain relief for the immediate locality in which he lived.

Because of the urgent clinical aspects of this question, which appealed so strongly to physicians, it was not difficult to secure their cooperation in an organized effort for reform. Accordingly, in December, 1892, the plan, which had been several years in preparation, was presented to the Practitioners' Club in Newark, N. J., and met with its indorsement. The plan was without precedent and provided for a commission of medical men, which, by voluntary supervision and control of methods, paid expert inspection of dairy work and final certification of the product, undertook to influence a supply of milk produced under regulations imposed by themselves which should fulfill the most exacting requirements of the physician.

This original commission was appointed by the Practitioners' Club and is still known as the Essex County Medical Milk Commission. Its pioneer work was performed with many misgivings and with great expenditure of time and thought. After passing through many vicissitudes, its plans were finally legalized in the comprehensive State law which now protects the professional interests, and, in fact, every feature of the medical milk commission's activity.

The plan provides that the medical commission establish correct clinical standards of purity for the milk, become responsible for periodical expert inspections of the dairy or dairies under its patronage, provide for frequent examinations of the product by a chemist and a bacteriologist, the first to determine its food values and the latter to serve as a detective control over the methods employed in collecting and handling the milk.

The medical commission also directs a frequent scrutiny of the live stock by competent veterinarians, whose duties consist in keeping the herd free from disease and also in the detection and exclusion of bovine tuberculosis. Likewise the commission directs a systematic medical supervision of the health of the dairy employees, and insists upon a continuous knowledge, through reports by a physician, of their health and personal hygiene. By the service of reliable experts in these four departments safeguards are established against the common dangers of impoverished and contaminated milk.

The code of requirements includes sureties for its fulfillment, necessary forfeiture clauses, a territorial limit for the sale of the product, and provision for the compensation of the experts appointed by the commission. It controls the character of the land used for pasturage and the cultivation of fodder; determines the location, construction, ventilation, and drainage of buildings; provides for an abundant and pure water supply, and prevents the use of water from wells or springs holding surface drainage. It requires cleanliness and order in the stable and does not allow the keeping of any live stock, except for milking purposes, near the dairy buildings. It regulates the assortment of the herd with reference to uniform results, as well as the health, the breed, and the temperament of the animals. It excludes animals that are tuberculous or are found in a state of health prejudicial to the herd. It provides for proper housing and shelter of the animals, together with their grooming, their treatment, and the prompt removal of waste from the stable.

It regulates the feeding, with reference to uniformity in the chemical composition of the product, and restrains the use of all questionable or exhausted materials for food. It governs the collection and handling of milk by insisting upon a proper regard for cleanliness, as viewed by the bacteriologist in its relation to the animal, her surroundings, the milker's hands, the vessels, and the association of persons handling the milk with immediate or remote sources of infection. By minutely specified requirements it controls every step in the cooling of the milk, and in its preparation for shipment, and adds to the product every detail of the care necessary to promote its keeping qualities or to favor its safe transportation. The product of such medical control of milk production was given a name, and when coining the term "certified milk" it did not occur to its author that it would be comprehensive enough to cover the activities of many medical milk commissions; but time makes thought more concrete, and the development of an idea extends its application. The definition of the term "certificate" is "a documentary declaration regarding qualifications, service, conduct, or other advantageous facts; it is more official than a recommendation and does not proceed like a license from a public authority."

MEMBERSHIP ON THE COMMISSION.

The Medical Milk Commission is logically organized to include in its membership only those who by special training can best direct these various agencies in the attempt to obtain clinically clean milk. The physician is the proper custodian of health, and his knowledge equips him to judge what conditions are inimical to human life.

It is for this reason that the Medical Milk Commission is strictly a medical organization, and, in order to protect its high purposes and the professional reputation of its members, it must receive the appointment or indorsement of a representative medical society.

The membership in these commissions, as organized on the American continent, ranges in number from 3 members to 100. The experience of the original commission in Essex County, N. J., would justify the wisdom of limiting the membership to 12, a majority of whom should be physicians.

Since the experts who work under the direction of the commission are paid officers, and in most instances are paid by the dairymen, it seems best that these should not be members of it, but be designated for employment by the commission, and be responsible to it, so that they may at any time be removed for just cause.

Less than 12 members can not well perform the duties devolving upon these commissions, provided that the four lines of supervision as indicated by the plan are effectively carried out. It is desirable that three members of the commission should together be responsible for each one of the four features of the medical control, and that each individual should, after a personal inspection of the dairy at least four times every year, report to the commission on the fulfillment of the requirements.

SPECIAL FEATURES OF THE PLAN.

The meetings of the commission are held at short intervals at a stated time and place. The quorum is small, to insure the transaction of business, and, if the reports of the experts are satisfactory, the issue of the certificates. The reports of the bacteriologist, the chemist, the veterinarian, the dairy physician, and the visiting committees are read and discussed.

The dairymen and the veterinarian are often called upon to attend the meetings. The chemist's report includes the results of a complete bimonthly quantitative analysis of the milk. The bacteriologist's report includes the numerical findings of bimonthly examinations of the milk. The dairy physician reports on the health of every employee in the plant, the nature of any sickness, the method employed in its treatment, and on the isolation of any who are ill with infectious disease.

It will be found necessary for milk commissions to exercise patience in realizing many of their plans. Educational influences are always slow, and in this matter the installment of new methods for obtaining results must often wait upon increased business to warrant the outlay.

The price of the product determined by the commission is not an insignificant factor in the success of the plan. Expensive requirements may call for the expenditure of large sums by the dairymen, such as installing ice plants or electric light and power. While no milk fit for ordinary domestic use can be produced with profit to the dairyman for less than 6 cents a quart as first cost, milk of a suitable grade for hospitals or for infant feeding can not be sold at a profit for less than 15 cents per quart.

RESULTS OF THE PLAN TO CERTIFY MILK.

It has thus been found possible to combine two diverse interests to effect a public good, and that a purely scientific scheme may be worked together with and influence a commercial institution. A most gratifying result has been the universal confidence in the gratuitous and disinterested work of the commissions, and the character of the product has been such that almost the entire output of the certified dairies is employed by physicians in their work.

The clinical standards adopted by the commissions have in the main been realized, but this is because they represent reasonable requirements, which automatically advance as more improved conditions become possible.

The examinations of the milk by a bacteriologist have done more than any other feature of the supervision to improve the milk. The reduction of the bacterial contaminations is the most difficult problem to solve, but an average of not more than 10,000 bacteria per cubic centimeter can be maintained throughout the year if the man in charge of the milking is experienced, is in sympathy with the requirements, is familiar with the principles and practices of cleanliness, and has been trained for his work.

The reports of frequent chemical analyses of the milk, which show its relative food values, have been useful to those who employ the product for accurate percentage feeding of the young. The close supervision of the health of the workmen by a qualified physician has made it possible to prevent communicable disease among the men employed in a plant producing thousands of quarts of milk daily during a period of 15 years.

The veterinary inspections have been far-reaching in their results. By inspection and tuberculinization of all animals before they are brought to the plant, and by the semiannual retest and the prompt isolation of every animal in ill health, it has been possible to keep a herd of milch cows almost continuously free from conditions which would jeopardize the milk.

The keeping qualities of certified milk are remarkable: it can be taken on trans-Atlantic voyages and kept sweet throughout. It may be sent over for the return voyage. Certified milk has been received in New York after having been shipped to Liverpool on a trial trip

21 days before; and by sending 1 quart to the chemist and 1 to the bacteriologist, it was found that the chemist kept his quart 11 days unimpaired and on the thirtieth day the last remaining quart was still sweet. Thus far this work has been largely educational and experimental, and yet the physicians who are giving their time to it have seen practical results as respects the very superior quality of the milk, the approximation to the standards adopted, and the benefits derived from its use in the nourishment of atrophic infants.

It is highly desirable that this work should be organized and carried on by medical commissions in every large center of population and that there should be some uniformity of requirements for certified milk, because it is chiefly designed for accurate medical and dietetic purposes.

The plan was duplicated in 1896, three years after the first commission was organized, with the formation of commissions in New York, by Drs. Holt, Freeman, and Chapin, and one year later, in Philadelphia, by Dr. Hamill. Medical milk commissions appointed by medical societies multiplied rapidly until six years ago there were 22 at work in the United States. They were then recognized by the Government. The Surgeon General and the Secretary of Agriculture issued educational bulletins on the subject. Through the initiative of the Cincinnati Academy of Medicine these commissions were federated into a national association to promote the growth of the plan and to legislate upon and harmonize the standards of and adopt uniform methods and regulations for all commissions.

This association admits to its membership only those commissions and their members which have been appointed by a medical society in good standing; also, professional sanitarians and reseach workers in hygienic laboratories.

At Atlantic City, in 1906, its membership was 300, with 36 component commissions. This year at the sixth annual meeting, in Louisville, Ky., its membership was 500, with 63 component commissions in the United States and Canada.

This body of physicians exerts a great influence for good through its educational propaganda, by its leadership in the pure-milk movement, and by its effect upon the character of all milk consumed by the people of North America, which, in the United States alone, is approximately 10,000,000,000 quarts annually, or 2 gallons a month for each individual of the urban and suburban population. These statements emphasize as important that the term "certified milk" should not be degraded or employed by producers of market milk who are not in contract with or under the control of a medical milk commission; that standards of purity and quality for such milk should be determined legally, so that the commissions, their producers, and the public shall be protected against deception and misbranding. It is also important that the medical commissions, as voluntary unpaid bodies with great responsibility, should have a legal status.

Legislation to cover these points has been sought by many of the commissions throughout the United States. New York added a rider to her pure-food law protecting the term "certified milk" against falsification and regulating its employment by the commissions. Kentucky, California, and Michigan followed with similar measures, but it seemed desirable, since the plan had its origin in New Jersey, that a law should prevail there to serve as an example to influence similar legislation in other States.

Such an act was passed by the New Jersey Legislature in 1909. It was inspired by and drawn under the direction of the Essex County Medical Milk Commission. The act includes every phase of milk commission activity; it is designed to protect professional interests and encourage the multiplication of commissions throughout the State and the production of "certified milk" in every large community.

It recognizes the National Association of Commissions as the final arbiter of standards, methods, and regulations; it also defines the powers, and confers upon the medical commission a legal status.

Soon after the organization of the American Association of Medical Milk Commissions, in 1906, it became apparent that there was a great lack of uniformity in the quality, purity, and safety of the product resulting from the activity of the commissions in the United States.

Attempts were made from year to year to adopt methods, regulations, and standards for the guidance of these commissions, of which there have come to be a large number in this country. These standards related to the hygienic, chemical, biological, veterinary, and safety features of the plan to obtain clean milk, but were not assembled in a comprehensive code embodying all that was best in methods employed by the leading commissions and taught by the best authorities.

At the annual meeting held in Philadelphia in 1911, a committee, composed of Asst. Surg. Gen. John W. Kerr, Dr. S. McC. Hamill, and the writer, was appointed to prepare a code of working methods and regulations, including definite standards of purity, quality, and safety for certified milk, which should become the standards of the association and a guide for all commissions, so that certified milk shall be the same and equally reliable in all places.

The committee carefully studied all literature relating to the subject, issued a questionnaire to all known commissions throughout the world, sifted the replies to 69 questions from 44 commissions, and rendered its report to the sixth annual meeting, held in Louisville, May 1, 1912. The report was adopted as the national code of standards, and constitutes the official manual of methods and standards for the production and distribution of certified milk. It was published in Public Health Reports, June 14, 1912, by the Public Health Service of the United States.

THE FUNCTION OF VOLUNTARY ORGANIZATIONS IN THE CAMPAIGN FOR THE BETTERMENT OF MILK PRODUCTION AND DISTRIBUTION.

NATHAN STRAUS, New York City.

PUBLIC DUTY AS TO MILK SUPPLIES.

I do not for one moment admit that the betterment of milk production and distribution is properly the work of voluntary organizations. It is the duty of the public authorities to see that the milk supplies are pure and wholesome. I have maintained this position from the very beginning of my own work, a score of years ago, and within the last five years it has come to be recognized that the municipality and the State are primarily responsible for the milk supplies.

This was the position I took in my letter to the mayors of the American cities on June 8, 1895, and in the paper that I submitted at the National Conference of Mayors and Councilmen at Columbus, Ohio, on September 29, 1897, in which I said:

> I appeal to you as if you were standing beside a great river in whose current were constantly swept past hundreds of drowning infants. This stream is a very real thing, if people would but recognize its existence, and all its yearly tribute of death is paid because of the public neglect of some of the simplest precautions for the saving of children's lives.
>
> You, gentlemen, have the means under your control by which these drowning babies can be saved. I ask you, will you not apply them? Men are found capable of acts of heroism in presence of danger less threatening and less surely fatal.
>
> All that I plead for is the extension of the activity of local boards of health in a sphere which is legitimately theirs, but which they have, so far, lacked the conviction and the courage to occupy. I shall not have spoken in vain, if I have succeeded in impressing you with the fact that the dictates of humanity and of public duty combine in demanding that this backwardness should exist no longer.

THE ONLY MEANS OF SAFETY.

Three years later, on November 15, 1900, having found by practical experience, extended over nine years, that there was no safety save in pasteurization, in a public appeal I said:

> Milk is the one article of food in which disease and death may lurk without giving any suspicion from its taste, smell, or appearance.

> If the pasteurizing of the entire milk supply were made the function of the municipality, it would be an exceedingly clever business investment, for the money expended would be returned a hundred fold. This is looking at it from a practical, commercial standpoint, besides which, from a humanitarian point of view, the amount of suffering and disease which would be prevented is incalculable.
>
> When the news of a railroad wreck and accompanying loss of life is telegraphed across the continent it is followed by a shudder of horror, and if any life-saving precautions have been lacking there is raised a cry of vengeance against the "soulless" corporation, whose duty it is to provide every safeguard for life.
>
> But what of the thousands of infants whose lives pay the penalty of lack of precaution? No shudder of horror passes over the land; no cry for reform is raised, yet just as surely as the proper precaution would have prevented that railroad catastrophe, just so surely would the lives of the thousands of these helpless infants be saved, did our municipal authorities adopt the preventive measures shown to be effective.

It was because the municipal authorities were not alive to their opportunity and their duty that there was place and work for voluntary organizations. It was because individuals and associations took up this work of protecting the babies and prosecuted it with increasing energy and effectiveness year after year that there has at length come a great awakening, and we now have boards of health in hundreds of cities more or less effectively working for the betterment of the milk supplies.

And it is because this branch of municipal endeavor is yet new, because the work is only partly done, that there is yet work for the voluntary organizations, both in teaching the municipal authorities what to do and how to do it, and in pushing them on to the full performance of their duty to the babies.

TUBERCULOSIS IN RAW MILK.

When the peril of tuberculosis in raw milk came forcibly to my attention, more than 20 years ago, there was practically no attention paid to this serious menace to humanity. In fact, the very man who had the distinction of isolating the tubercle bacillus scouted the idea that is now proved a fact, and with unscientific recklessness denied that consumption could be contracted by drinking the milk from tuberculous cows.

Therefore we had not merely an uninformed public to instruct, but a misinformed public to rescue from a foolish error. The peril of raw milk was a new idea. I was regarded as an alarmist when I wrote in the Forum in November, 1894:

> I hold in the near future it will be regarded as a piece of criminal neglect to feed young children upon milk that has not been sterilized (pasteurized). Milk is not always good in proportion to the price paid for it nor free from

the germs of contagion because it has come from cattle of aristocratic lineage. The latter quality, as recent experience has shown, carries with it special susceptibility to tuberculosis.

The time was not ripe; the way had not been paved for official action by the public health authorities to protect the public from dangerous raw milk. My warnings of the perils that lurked in milk were received with incredulity, derision, or open and bitter attacks. But I persisted, with the result that to-day medical men and sanitarians are in practical agreement, almost complete unanimity, upon this point.

DECISION BY EXPERTS.

The years that bridge the space between the warnings that I sounded in the early nineties and the recent report of the Commission on Milk Standards have been, for the most part, weary, discouraging years; but all that is now a matter of the past, and we have at last the deliberate decision of an able and impartial commission of experts that—

> While public health authorities must necessarily see that the source of supply and the chemical composition should correspond with established definitions of milk as a food, their most important duty is to prevent the transmission of disease through milk. This means the control of infantile diarrhea, typhoid fever, tuberculosis, diphtheria, scarlet fever, septic throat infections. and other infectious diseases, in so far as they are carried by milk.
>
> Septic sore throat deserves special mention because of the frequency with which outbreaks of this disease have in recent years been traced to milk supplies.
>
> The commission recognizes the magnitude of the milk industry, and that the improvement of milk supplies is primarily an economic problem.
>
> But while the basic problem is economic, and must eventually be solved by commerce, public health authorities must show the way and must establish standards and regulations in the interest of consumers, the value of which even the consumers themselves often fail to appreciate.
>
> While the process of pasteurization is a matter which has attracted a great deal of attention in recent years, the commission has not entered into any discussion of its merits or demerits, but has given it recognition in its classification as a process necessary for the treatment of milk which is not otherwise protected against infection.
>
> The commission thinks that pasteurization is necessary for all milk at all times excepting certified milk or its equivalent. The majority of the commissioners voted in favor of the pasteurization of all milk, including certified. Since this was not unanimous, the commission recommends that the pasteurization of certified milk be optional.

WORK OF NOTABLE VOLUNTEERS.

This much I have quoted from the clear and definite recommendations of the commission on milk standards. This report is the work of a voluntary organization, inspired by a voluntary organization, and summing up in its membership the vast deal of earnest study and practical experience that has been acquired in the great cooperative work of many individuals and associations.

It comes to us with the authority of 17 able, earnest, and eminent men, who have served humanity well, men whose names I recite here as illustrating the great work that has been done by volunteers in this fight that has been so vitally necessary to the protection of humanity and of its most helpless members—the babies:

Dr. W. A. Evans, professor preventive medicine, Northwestern University; health editor Chicago Tribune, Chicago, Ill., chairman.

Dr. B. L. Arms, director of bacteriological laboratory, department of health, Boston, Mass.

Dr. John F. Anderson, director of Hygienic Laboratory, United States Public Health Service, Washington, D. C.

Prof. H. W. Conn, director of bacteriological laboratory, Connecticut State Board of Health; department of biology, Wesleyan University, Middletown, Conn.

Dr. E. C. Levy, health officer, Richmond, Va.

Dr. A. D. Melvin, Chief of Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

Dr. William H. Park, director of laboratories, Department of Health of New York City, foot of East Sixteenth Street, New York City.

Mr. Raymond A. Pearson, commissioner of agriculture, Albany, N. Y.

Dr. M. P. Ravenel, director of hygienic laboratory, University of Wisconsin, Madison, Wis.

Prof. M. J. Rosenau, department of hygiene and preventive medicine, Harvard Medical School, Boston, Mass.

Prof. Henry C. Sherman, department of chemistry, Columbia University, New York City.

Dr. A. H. Stewart, antitoxin laboratories, department of health and charities, Philadelphia.

Dr. William Royal Stokes, bacteriologist to State and city health departments, Baltimore.

Prof. William A. Stocking, department of dairy industry, Cornell University, Ithaca, N. Y.

Mr. Chester H. Wells, health officer, Montclair, N. J.

Dr. L. L. Van Slyke, department of chemistry, New York Agricultural Experiment Station, Geneva, N. Y.

Dr. Charles E. North, consulting sanitarian, member New York milk committee, New York City, secretary.

This commission's platform of effective and efficient measures for the betterment of milk production and distribution comes as the sequel of a quarter of a century of voluntary labors on behalf of the babies—it comes as the flower and fruit of efforts of which my own have been only a part.

But my subject is not entirely retrospective. Voluntary effort and voluntary organization have worked out a definite and comprehensive plan of betterment that is fully and emphatically indorsed by the Public Health Service and the Department of Agriculture, that is indeed but a modification of the measures advocated by these Federal agencies as a result of the thorough investigation of the milk problem by the Public Health Service under President Roosevelt.

This program needs to be applied and enforced in every city of the land.

This, I maintain, is the chief and imperative work and duty of voluntary organizations at this stage of the campaign for the betterment of milk production.

All infant milk depots maintained by private philanthropy are but examples to the municipalities of what ought to be done by the public officials with public funds. All milk committees are first and chiefly agencies charged with the responsibility of seeing to the adoption and enforcement of this program that has grown out of a quarter of a century of earnest work.

FUNCTION OF MILK DEPOTS.

In regard to the function of milk depots I feel obliged to emphasize one lesson from my own long experience, namely:

That the fundamental and vital duty of the milk depot is to furnish milk in nursing bottles, one feeding to the bottle, properly modified according to formulæ suited to the different ages of babies, and pasteurized in the bottles. This assures the highest degree of safety.

The supplying of dipped milk—of milk drawn from cans and put in containers brought by the mothers—ought to be rigorously prohibited. It is bad enough to allow dipped milk to be sold for general use. It is criminal to supply milk in this way for babies, however good the milk may be in the first place, for the reason that the sensitive fluid is thus exposed to contamination.

I must maintain, therefore, that the milk depot fails to fulfill its primary object unless it supplies milk for infant feeding—milk modified and then pasteurized in the nursing bottles.

As to the efficacy of this direct and simple method of preventing sickness among the babies, I wish to cite the record of my own work in New York City during the past summer:

With an average of 2,200 babies supplied with milk from my laboratories there was just one death, and that was due to pneumonia.

In this connection I should say that in all the 21 years of my work I have been guided in all things by the friendly advice of that greatest of all specialists on infant feeding, the dean of the American medical profession, Dr. Abraham Jacobi, whom the medical men of two hemispheres delight to honor.

DISTRIBUTION OF MILK.

Instruction of mothers is important. Medical attention is important. I have always supplied both. But these things are secondary, and I can not but regard it as a grevious error to treat these things as fundamental, and to make secondary the dispensing of the food the babies require—for it is food, clean, safe, wholesome food, that the babies need more than anything else in the world.

I speak of this frankly and plainly, because there is an unfortunate disposition on the part of well-meaning people to exaggerate the "consultation" to the detriment of the fundamental duty of the infant milk depot. In some cases the resources of the organization are exhausted upon nurses and doctors, and little is done in the way of feeding the babies. The mothers are overwhelmed with instructions, while the babies cry in vain for the food that is their essential need.

And so it has been in New York, where my 17 depots are the only ones out of a hundred that supply modified pasteurized milk in nursing bottles ready for use upon warming.

Nothing could be further from my purpose than to discourage the well-meaning people who have taken up this work, but I think I have a right to speak out of my experience, which has extended over a longer term of years and has reached more babies than any other work, and to say to the people who have lately embarked upon this important work in all kindliness and sincerity that they are in danger of minimizing the real effectiveness of their efforts.

HOME PASTEURIZATION.

As to modification and pasteurization of milk in the home, it is indeed very desirable that the mothers should be taught how to prepare the milk for their babies, and I have tried to make it easy for them to do so by devising a simple home pasteurizer. But even its use is feasible only for the better situated classes. Where the mother goes out working, returns in the evening tired, worn out by her labors, to find perhaps her baby crying for its bottle, it is cruel to demand that she should follow out the complicated and difficult process of modification and pasteurization. Besides, it must be remembered that conditions in tenements do not ordinarily make it possible for mothers to do this work properly and with the scrupulous cleanliness that is essential.

The object, therefore, should be not to substitute home-prepared feedings for those supplied by the milk depot, but to encourage the use of the depot milk where it can be had, and only to teach the mothers how to prepare the feedings where they can not get the better prepared milk from properly conducted pasteurized milk depots.

And in case of home preparation, with all the increased probability of contamination, it is even more than otherwise necessary to insist strictly upon pasteurization.

In all that is said of infant milk depots, it is ever to be remembered that these institutions are for babies that, for one reason or another, are deprived of the better sustenance of breast feeding, and the very first duty of all these institutions is to persuade and encourage mothers, wherever it is physically possible, to nurse their babies as nature intended.

PURPOSE TO BE KEPT IN VIEW.

To sum up briefly, all individual or organized voluntary efforts will fail of their purpose unless they tend directly and powerfully and unitedly to fix the responsibility where it belongs—on the municipal and State health authorities; unless they tend to compel such authorities to take up energetically the work of regulating milk production and distribution and the maintenance of pasteurized milk depots for the babies; unless they see to it that the work of such public agencies is carried out definitely and uncompromisingly along the lines set by the Commission on Milk Standards and the Public Health Service.

Many days will pass before these results are achieved, before the milk supplies of our cities are really and efficiently safeguarded by the officials charged with that duty. Meanwhile there is work to be done.

The babies cry for protection against disease; their mothers lift their hands in frantic supplication for their little ones. Disease and death throw their shadow over the cradle and engulf the mothers of the land in the inextinguishable sorrow that we can ward away from the home.

It is a call to battle—a call to united and energetic action. In this emergency it is not enough to talk; it is not enough to educate the public and the health officers. We must do all this, but we must do more. We must bend all our energies, strain all our resources to save the babies that are now living and all those who will come into the world before the tardy hand of official administration has been quickened and strengthened to grapple with this menace to the home and to the land.

GREAT POSSIBILITIES.

We need infant milk depots, we need doctors and nurses consecrated to the work of assuring to the little ones the food that they need free from the taint of disease. We need the cooperation of the poor and the purses of the rich. As I have often said, it is a work beyond the means of any one man or set of men—it is a work for all men and all women.

It is a work too big and great with possibilities of human good to afford room for jealousies or for disputes about nonessentials or about methods. It is not a clinical work. The babies are human beings, not subjects for study and exhibits for committees or doctors. They are human beings threatened with death, and it is our function to save them—not to talk about them, not to experiment with them, not to catalogue them, but to give them the chance to live that they can have only in properly pasteurized milk properly modified, with such medical attention as may be needed in particular cases.

This is a work to stir the good red blood in every man and woman who has the fundamental instincts of humanity, a work that has greater possibilities of good than any other that I have ever heard of, a work that will pay dividends in the satisfaction that can come only in helping the little ones, in making their hands chubby and their faces rosy, and giving them the fair start in life to which they are entitled.

THE CASE FOR PASTEURIZATION.

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Few practical sanitary questions have aroused so lively and even intense feeling as the pasteurization of milk. Pasteurization has been called a "makeshift" and a "mere makeshift"; the secretary of the Illinois State Board of Health has referred to it as "an unreliable remedy for an uncertain danger." It is declared to be "an incentive to uncleanliness," to "encourage slovenliness" on the part of the producer and milk dealer, and to postpone indefinitely the time when only "clean, raw milk" shall be marketed.

On the other side there are equally enthusiastic advocates. The controversy over the merits of pasteurization has now been going on for some years, and there are reasons why it seems desirable at the present time to summarize the evidence accumulated for and against the pasteurizing process.

PASTEURIZATION.

Like many similar terms, the name "pasteurization" has been loosely applied. This is in part due to the early use of the term by scientific writers for exposure to temperatures below the boiling point without exact specification of the temperature used and the time of exposure. Confusion was at first unavoidable since exact data were not available. Through the work of T. Smith,[1] Russell and Hastings,[2] Hesse,[3] Rosenau,[4] and others it is now established that the tubercle bacillus in milk loses its infective power for guinea pigs when the milk is heated to 60° C. (140° F.) for 20 minutes. If the milk is maintained at 65° instead of 60°, a shorter time will suffice. Other pathogenic bacteria sometimes present in milk, such as the bacilli of typhoid fever and diphtheria, are more readily killed by heat than the tubercle bacillus. As the result of many experiments it has been found that it is not safe to use temperatures lower than 59° or 60° C. (139° or 140° F.), since such temperatures do not insure destruction of pathogenic forms. On the other hand, it is desirable to keep the temperature to the lowest point that will still be bacterially effective, in order to minimize changes in the milk due to heating.[5] Exposure of milk in properly constructed pasteurizers to a temperature of 60° to 65° C. for 20 minutes surely destroys the tubercle bacillus and other pathogenic bacteria and does not affect appreciably the chemical or the "biologic" properties of the milk. That such a standard can be applied to work carried on under practical as well as laboratory conditions has been shown by many experimenters.[6]

Certain types of pasteurizing machines need to be carefully controlled in order to insure that the total volume of milk is heated to a definite temperature and held there for a sufficiently long period. Schorer and Rosenau,[7] after careful experiments on the germicidal efficiency of a large commercial pasteurizer, conclude that a liberal factor of safety is necessary. They recommend 145° F. (63° C.) as the best temperature to meet practical conditions, and advise that the milk should be held at this temperature from 30 to 45 minutes. They also find that a single holding tank is not so trustworthy as two, three, or four in a series.

Although the establishment of a reliable working standard has been made possible through the experiments above referred to, a source of confusion for the general public still exists in the misuse of the term "pasteurization" by purveyors of milk. This is a kind of misbranding that concerns closely public health administration. At present it is possible in most American cities to sell milk as "pasteurized" which has never been subjected to proper control. Much of the existing procedure is simply pasteurization falsely so called. Milk heated to a temperature as low as 55° C. (131° F.) may perhaps keep somewhat longer than raw milk, but can not be regarded as bacteriologically safe. Again, milk dealers often use machines designed to expose milk for a brief period to a high temperature, such a method being known as the "continuous" or "flash" process in contradistinction to the "holding" process. Experiments have shown that, bacteriologically considered, the flash process is less reliable than the holding process. Several types of "pasteurizing" machines are marketed, and the efficiency of each type and to some extent that of individual machines can be determined only by actual experiment. Observation made under laboratory conditions are not directly applicable to pasteurization on a large scale.[8]

It is plain that to subject milk to an uncertain and variable temperature for an indefinite and variable time does not entitle the resulting product to the name "pasteurized." Hence the necessity today for an official technical definition of the term "pasteurization." The available data exist or can be readily secured. City ordinances should be drawn in a uniform manner, inspection and control of pasteurizing appliances and methods should be carried out, licenses should be issued, and misbranding made a legal offense.

The relation of milk to infant mortality needs special consideration. To determine the effect of milk on the health of infants involves many difficult and intricate questions. Cow's milk is not the normal food for human babies and it is often impossible to discover to what extent digestive disturbances in young children are due to the natural unsuitability of the milk as a food substance and to what extent they are due to abnormalities in the milk. In general it is true that during hot weather raw milk with a high bacterial content is much more likely to produce illness or to predispose infants to illness than a fresh, clean milk containing few bacteria. During cool weather neither the health nor the mortality of infants seems to be appreciably affected by the number of bacteria milk contains. The evidence, as far as it exists, indicates strongly that milk destined as infant food should be as clean and fresh as possible, but it does not indicate the precise way in which stale and dirty milk produce their evil effects. Infants, like adults, are of course liable to specific infections conveyed in cow's milk and, as pointed out, are especially liable to contract tuberculosis from germs coming from the cow.

Since milk-borne diseases are to a considerable extent due to the use of milk from diseased cattle, to uncleanly dairy surroundings and to careless handling, it has been generally assumed that contamination and infection can be prevented by sanitary control of the process of milk collection and transportation. One important object of the campaign for clean milk and inspected milk so effectively waged by the medical milk commissions in this country has been the prevention of disease transmission. There is no doubt that the amount of milk-borne infection can be greatly lessened by such procedures as examination and testing of the dairy cattle, insistence on scrupulous cleanliness of the dairy surroundings and dairy employees, elimination of the house fly, the reporting of infectious diseases developing on the dairy farm and among all employees, and, in a word, by all precautions that bacteriologic experience can suggest.

The question is beginning to be asked, however, whether it is humanly possible to eliminate all important sources of infection, even by strict regulation and watchful supervision.[9] The discovery that entirely healthy persons can be the bearers of virulent disease germs and can convey these germs to objects with which they come in contact has already had an important effect on public health practice and is nowhere more significant than in connection with the control of milk supply. The New York City milk supply comes from 44,000 farms, and probably over 200,000 persons are concerned in its production.[10] The Chicago milk supply is derived from over 12,000 farms. Even supposing that the large body of individuals that are in close contact with the milk during collection, transportation, and distribution can be properly trained and disciplined in some of the methods of the bacteriologic laboratory, unforeseen changing and shifting in the personnel is necessarily always taking place. Furthermore, a permanent and healthy employee may suddenly acquire a virulent disease germ and perhaps become a "carrier" overnight, without there being any reason for him or his employers to recognize that he has become dangerous or to lead in any way to suspicion of his condition. A new milker may be engaged in a certified dairy and even if he is subjected to prior bacteriologic examination may conceivably be an "intermittent typhoid carrier," i. e., discharging typhoid bacilli only at intervals. Such a person may become dangerous within a few weeks or even a few days after he is taken on. He may never have been treated by a physician for typhoid fever and may have no ground whatever for supposing that he has suffered from the disease. In this case careful questioning and even bacteriologic examination might fail to elicit any cause for suspicion. The inefficiency of ordinary hand washing is shown by such observations as that of Winslow,[11] who found the colon bacillus present on the hands of between 5 and 10 per cent of all persons examined; it is well known that nurses in typhoid fever hospitals who are presumably cognizant of their danger nevertheless frequently become infected. Whether it is practicable to enforce bacterially effective hand cleansing in all milkers is a matter on which there may be some room for doubt. Nor can the danger from infective droplets, discharged from the mouth by coughing, sneezing, speaking, or laughing be overlooked. Flügge and his pupils have shown that such droplets may float for some time (30 minutes) and to some distance (3 or 4 feet). A slight unconscious cough by a milker who is well, but a carrier, may be the means of conveying infection to the milk. It is hardly necessary to add that most pathogenic bacteria when introduced into milk do not remain quiescent or even begin to die off as happens when they pass into water, but enter on a course of rapid multiplication which may result in spreading infection through a large volume of mixed milk.

THE ADVANTAGES OF PASTEURIZATION.

Assuming that pasteurization is definitely and legally recognized as an exposure for 20 minutes to a temperature of 60° to 65° C. (140° to 149° F.) or is defined in some similar way in accordance with the available bacteriologic data, what are the advantages, if any, to the public health from the general pasteurization of milk supplies? Theoretically, general pasteurization should reduce the amount of milk-borne disease. Does it in point of fact do this? Unfortunately, the data are very meager.

There are few if any instances in which the conditions satisfy the requirements of a scientific experiment, where change from a raw milk supply to an effectively pasteurized one has taken place abruptly, and has been accompanied by no essential change in other hygienic factors. Sudden and radical changes in the character of a city water supply often takes place, but not in that of a milk supply. As a rule the pasteurization of city milk is introduced gradually and is not of uniform efficiency. In some cities the "flash" method is employed exclusively,[12] in others the "holding" method, but in most cities both methods are in use. Official control of the pasteurizing process is at present far from effective and it is impossible in many cases to be sure what proportion of the city milk is really pasteurized in the strict bacterial sense. For these reasons the actual effects of general pasteurization can not often be demonstrated.

At the same time evidence is accumulating as to the efficacy of pasteurization in preventing milk-born disease. There are some specific instances like the one reported by Rosenau, Lumsden, and Kastle,[13] who found that the lowest proportion of typhoid fever cases on any milk route in Washington in 1906 and 1907 was on the route of the only dealer who sterilized his milk bottles and pasteurized the milk.

It is generally known also that typhoid fever is as a rule more prevalent in the cities of the United States than in European cities of corresponding rank. This is true even of those American cities possessed of a perfectly good public water supply. The most plausible explanation for the existence of this high typhoid rate in American municipalities is that the almost universal practice in continental Europe of heating milk shuts out this food as a common source of typhoid fever, while in this country the general use of raw milk opens the door wider for infection by this channel.

It is a tempting hypothesis that the striking decrease in typhoid fever that has occurred in some American cities in the past few years is in large part due to the increased proportion of pasteurized milk sold in these cities. In Chicago, for example, about 2 per cent of the milk supply had been pasteurized prior to 1908. In July, 1908, an ordinance was passed to take effect January 1, 1909, requiring pasteurization of milk from herds untested with tuberculin. This led quickly to a pasteurization of something over one-half of the total milk supply. In 1910 it was estimated that 75 per cent of the supply was subjected to the heating process. Table 1 gives the death rate from typhoid fever in Chicago for the years since the opening of the drainage canal, an event which was accompanied by cessation of the extreme city water-supply pollution which had previously prevailed.

TABLE 1.—*Chicago typhoid death rate after opening of drainage canal.*

Year.	Typhoid fever deaths per 100,000 population.	Year.	Typhoid fever deaths per 100,000 population.
1900	19.8	1906	18.5
1901	29.1	1907	18.2
1902	44.5	1908	15.8
1903	31.8	1909	12.6
1904	19.6	1910	13.7
1905	16.9	1911	10.8

Average prior to 1908,[a] with 2 per cent or less of milk pasteurized	24.8
Average of the lowest three typhoid rates prior to 1908	17.9
Average 1909, 1910, and 1911, with 50 to 75 per cent of milk pasteurized	12.4

[a] 1908 omitted as being a year of transition, and toward its close of increasing pasteurization.

Whether or not the marked decline in the Chicago typhoid death rate since 1907 is really the effect of pasteurization, the coincidence is worthy of attention.

In Boston a similar decline may be observed (Table 2):

TABLE 2.—*Boston typhoid death rate.*

Year.	Typhoid fever deaths per 100,000 population.	Year.	Typhoid fever deaths per 100,000 population.
1891–1895	31.1	1906–1910	16.0
1896–1900	30.6	1911	9.1
1901–1905	22.4		

Average of the lowest typhoid rates prior to 1909	16.9
Average of 1909, 1910, and 1911	11.5

In 1910 about one-half of the Boston supply was said to consist of heated milk; in 1911 a still larger proportion. In 1911 only 479 cases and 63 deaths from typhoid fever were reported, the smallest numbers absolutely as well as relatively ever recorded in the sanitary history of the city.[14] Other factors have doubtless been at work to reduce the amount of typhoid fever, but it is hard to resist the conclusion that the increasing use of heated milk is largely responsible for the recent striking diminution.

In New York and a number of other American cities the pioneer philanthropic work of Nathan Straus has made possible the establishment of milk depots from which pasteurized milk has been distributed. The establishment of such milk depots has been followed in every instance known to me by a noteworthy reduction in infant mortality. Freeman,[15] as the result of his studies in the city of New York, came to the conclusion that by far the most important agency in bringing about the " striking decline " in infant mortality was the general adoption of pasteurization and sterilization of milk for infant feeding. It is, of course, not possible to attribute the total reduction in infant death rate to the use of heated milk, since usually other factors, such as education of the mothers in methods of feeding, the use of milk modifications and similar improvements have been simultaneously put in force, but there seems little doubt that at least some share in the reduction is to be credited to the use of pasteurized milk. Further detailed studies of the effect of pasteurized milk on the health of babies would be of value.

The low cost of pasteurization [16] as compared with farm inspection is a point in its favor. Even assuming that farm inspection were as efficient as pasteurization in preventing the delivery of living disease germs to the milk consumer, the cost per case of disease prevented would probably be much greater by the inspection method than by the pasteurization method. The economic advantage of pasteurization to the milk dealer by preventing rapid souring is sufficiently obvious and need not be dwelt on here.

OBJECTIONS TO PASTEURIZATION.

Many objections have been urged against pasteurization. Some of these have reference to the inherent nature of the process, others to remediable defects in current procedure. To declare that pasteurization is " a fraud " because some unscrupulous dealers try to palm off heated dirty milk for clean raw milk is about as reasonable as to maintain that weights and measures should not be used because they make practicable cheating under the guise of accuracy. It is self-evident that the process of pasteurization should be regulated and controlled, and that pasteurized milk, like raw milk, should not be sold except under official sanction. If " commercial pasteurization " is to-day carried out on wrong lines, municipal regulation must set it right. To insist that inspectors may be corrupt is not an indictment of pasteurization but of municipal government, or some may choose to say, of democracy. In point of fact, municipal supervision and regulation are exercised efficiently to-day in more complicated matters than the pasteurization of milk. It is clear that some of the oft-repeated objections to pasteurization are based on a mere matter of deceptive labeling. Calling milk pasteurized does not make it so. Objections to " commercially pasteurized " milk do not hold for properly heated milk.

It is sometimes alleged that pasteurization does not avoid the danger of milk transmission of disease, since fresh infection of the milk after pasteurization may occur.

A curious objection which is sometimes advanced is that the " life " of the milk is destroyed by heating and that this impairs the value of the milk as human food. In this crude form the objection is evidently meaningless. Even if the destruction of milk enzymes by heat is implied by such an objection there is hardly more foundation for the claim. The enzymes in milk are for the most part resistant to temperatures of 60° to 65° C. for at least twenty minutes.[17] In some cases, however, as with superoxydase (katalase), heating at relatively low temperatures (56° C.) will cause partial weakening or (62° C.) complete destruction. The feeble germicidal power that milk has for certain bacteria is also weakened by temperatures in the neighborhood of 60° C. The leukocytes present in normal milk are killed by heating, but there is no reason to believe that the maintenance of the integrity of these cells from the cow is in any way important in the process of assimilation in the alimentary tract of man. There are unquestionably changes produced in the milk by heating, especially in the labile compounds represented by the enzymes and antibodies of various sorts. Not a particle of evidence exists, however, for ascribing to such substances a favorable influence on human digestion and metabolism. The enzymes in raw meat or in raw potatoes are for all we know as useful as those in raw milk. It may be asked why bovine enzymes should be supposed to add anything to the efficacy of the enzymes normally present in the human alimentary tract. Until positive demonstration has been made that some benefit is obtained from the ingestion of milk enzymes, little importance can be attached to purely hypothetical considerations of this character.

EFFECT OF PASTEURIZED MILK.

After all theoretical objections have been canvassed, however, the practically important question remains to be answered whether infants fed with pasteurized milk are any better or any worse off than those fed with raw milk. Putting aside for the moment the question of the conveyance of specific infection or the possible deleterious influence of large numbers of bacteria, what is the effect on individual metabolism of milk heated for 20 minutes at 60° C. as compared with that of the same milk in a raw condition. It is well known that some experienced clinicians are inclined to attribute such conditions as scurvy or rickets in young children to the continued use of heated cow's milk, but on the other hand it is pointed out that similar metabolic derangements are observed in children fed with raw cow's milk or even in breast-fed infants. Brennemann's observations,[18] indeed, indicate that raw milk is much more likely than boiled milk to produce large hard curds which are surely a hindrance to digestion. No distinction is noted in some of the reported cases between boiled milk and pasteurized milk, and the data printed are often far from complete. Speaking broadly, there is no doubt that many infants can be fed without appreciable ill effect for long periods with heated milk—boiled or pasteurized—but this, perhaps, does not justify us in assuming that some individuals may not be injuriously affected. As regards boiled milk, rather convincing observations have been lately put forth by Janet Lane-Claypon.[19] There it is shown that while infants, like other young animals, thrive best on the milk of their own species, it is immaterial as far as nutrition is concerned whether the milk is boiled or not. Infants fed with milk drawn from the breast of a wet nurse and boiled previous to use appear to thrive just as well as when the same milk is given fresh. At the end of twelve months the babies fed on boiled milk showed no greater percentage of rickets than the breast-fed babies.

As the case stands there is no conclusive proof that infants are injured by being fed properly pasteurized milk instead of the same milk raw; on the whole we may rest reasonably assured that pasteurized milk is under most conditions as good for infants as clean raw milk.

Objection to pasteurization on the ground that it permits the continuance of uncleanly methods of collecting and handling has little weight. A simple test for the presence of dirt in the milk, such as that in use by the Chicago Health Department, may be applied to pasteurized as well as to raw milk.[20] It is self-evident that unless milk comes up to a certain standard neither delivery of the milk raw nor pasteurization of the milk should be permitted. In any case, some standard must be established and upheld.

HOME PASTEURIZATION.

"Home pasteurization" of milk is sometimes urged as preferable to pasteurization on a large scale by milk dealers. Under some conditions it is probably true that pasteurization can be carried out effectively in the home, but in many cases proper and uniform treatment can hardly be hoped for. As a rule attempts to induce householders to "boil the water" lead to less satisfactory sanitary results than centralized purification of the water-supply under expert supervision. With a little skill in laboratory manipulation, a good thermometer, and some time and patience it need not be a difficult matter to pasteurize milk successfully in the home. Unfortunately these requisites are not always found. There is reason to think that "home-pasteurized" milk is in general heated to an overhigh temperature and is not rapidly enough cooled.

THE NECESSITY FOR MUNICIPAL CONTROL.

All the foregoing considerations point unmistakably to one of the greatest needs in municipal health administration in many American cities to-day, namely, the enforcement of a pasteurizing ordinance. The observations of Koehler and Tonney[21] in Chicago exemplify the immediate need for municipal control of the pasteurizing process. While it is probably true that a certain amount of the highest grade clean, raw milk (certified) will continue to be asked for, the expense requisite for production will alone put certified milk for a long time out of reach of many consumers. The bulk of the city milk supply may be brought up to a certain qualitative level by competent inspection, but beyond a given point it can not be forced without an increase in cost not commensurate with the advantage obtained. Inspected milk of average quality may be rendered safe for human consumption by a process of real pasteurization prescribed and regulated by the municipal health authorities. No one cognizant of the facts can doubt that general pasteurization under official sanction will prevent a large amount of milk-borne disease. On the other hand, uncontrolled pasteurization opens the door wide to the abuses already mentioned. Under some conditions the name "pasteurization" may be made to serve simply the ends of careless producers or unscrupulous dealers. It is plain that the commercial exploitation of a scientific process should not be allowed to obscure the merits of the process. In the interests of public health, pasteurization should be technically and legally defined and should be subject to competent regulation.

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[1] Smith, T.: Jour. Exper. Med., 1899, iv, 233.

[2] Russell and Hastings: Rep. Wis. Agric. Exper. Sta., 1900, xvii, 170.

[3] Hesse: Ztschr. f. Hyg., 1900, xxxiv, 347.

[4] Rosenau: Bull. No. 42, Hyg. Lab., U. S. P. H. and M. H. S., Washington, 1908.

[5] From a commercial point of view the destruction of the cream line brought about by too high temperature is a marked disadvantage.

[6] See, for example, Rosenau: Bull. No. 56, Hyg. Lab., U. S. P. H. and M. H. S., Washington, 1909, p. 639. Trautmann: Gsndht. Ing., 1909, xxxii, 731. Hanne: Gsndht. Ing., 1911, xxxiv, 489.

[7] Schorer and Rosenau: Jour. Med. Research, 1912, xxi, 127.

[8] See, for example, Schorer: Am. Jour. Dis. Child., 1912, iii, 226.

[9] It is worthy of note that the majority of the Commission on Milk Standards appointed by the New York Milk Committee voted in favor of the pasteurization of all milk, including certified milk. See Standard Rules at the end of this article.

[10] Monthly Bull., New York Health Dept., October, 1911.

[11] Winslow: The Occurrence of the Colon Bacillus on the Hands, Jour. Med. Research, 1903, x, 463.

[12] Schorer: Jour. Am. Pub. Health Assn., 1911, i, 851.

[13] Rosenau, Lumsden, and Kastle: Bull. 44, Hyg. Lab., U. S. P. H. and M.-H. S., Washington, 1908.

[14] In 1856, when typhoid fever first appears under a separate heading, there were 70 deaths in a population of 163,820, and only once before 1911 was a lower number than this recorded—64 in 1907.

[15] Freeman: Med. News, Sept. 5, 1903.

[16] In Chicago the cost is said to range from one-thirtieth of a cent per gallon for large plants to 0.85 cent per gallon for one small plant. (Report of senate committee of the forty-sixth general assembly to investigate the tuberculin test and the pasteurization of milk and its products.)

[17] Kastle and Roberts: Bull. 56, U. S. P. H. and M.-H. S., 1909, p. 332. Seligman: Sommerfeld's Handbuch d. Milchkunde, 1909, p. 306.

[18] Brennemann: Am. Jour. Dis. Child., 1911, i, 341.

[19] Report to Local Government Board, N. S. No. 63, 1912; abst. Lancet, London, Apr. 27, 1912, p. 1140.

[20] Tonney, F. O.: Am. Jour. Pub. Health, 1912, ii, 280.

[21] Koehler and Tonney: The Journal A. M. A., Mar. 11, 1911, p. 713.

THE SANITARY BETTERMENT OF MILK PRODUCTION AND DISTRIBUTION.

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The improvement of the milk supply has engaged the attention of Washington for many years. The work done here repeatedly served as the model for regulations and legislation. Previous to 1894 repeated efforts had been made to secure legislation for the improvement of the milk supply. Congress did not heed the petitions.

On February 5, 1894, the late Dr. Charles Smart, of the Army, showed that the mortality was very high in this city from typhoid fever, malarial fever, and typho-malarial fever. It is safe to include all three diseases as typhoid. The total for 1894, then, would be 105.8 per 100,000. Assuming the mortality to be 1 in 10, there were in that year about 3,000 cases of typhoid fever in the District.

Dr. Coit has very properly given 1894 as the date of the initiation of the movement for the legal control of the milk supply. I can unhesitatingly claim the credit for starting this movement.

Impressed by the statements made by Dr. Smart, I brought them to the attention of the Medical Society of the city of Washington at the meeting held February 7, 1894. On my motion a committee composed of myself chairman, Drs. W. W. Johnston, and C. M. Hammett was appointed to investigate the prevalence and causes of typhoid fever in the District of Columbia. This committee gave five months' continuous attention to the work and reported to the society June 6, 1894. The medical society unanimously indorsed the recommendations of the committee, the more important of which were as follows:

The abandonment of all wells within the city limits.

Purification of the sewerage system by replacing all damaged or defective drains.

The introduction of new sewers in advance of other improvements and the extension of the system outside the city limits.

The completion of the plans for the sedimentation of the Potomac water and ultimately for filtration.

Careful inspection of all dairies in the District, and the enactment of a law forbidding the sale of milk without a permit from the health officer.

The propagation of the doctrine that immediate disinfection of the stools is the first duty of the physician.

On the 13th of June, 1894, the society presented its report to the Committee on the District of Columbia of the House of Representatives. This committee ordered the report to be printed as a congressional document.

The first important legislation secured was the milk law approved March 2, 1895. This gave Washington the honor of initiating inspection of dairy farms and dairy depots for the production and distribution of milk in the city before granting a permit.

Dr. W. C. Woodward was a member of the committee of the medical society that helped to frame the milk law. To him is due the credit of originating the score card for recording the results of the inspection. Congress has been repeatedly urged to enact appropriate legislation. But up to the present time Congress has continuously turned a deaf ear to all entreaties. In 1906, notwithstanding the completion of the filtration plant the typhoid death rate continued to be high in Washington. Facts showed that again milk was an important factor in the causation of the disease. These facts were brought by Mr. E. Berliner and myself to the attention of the District Commissioners who were urged to convene a conference upon the milk supply of the city.

This conference was held in the spring of 1907. Drs. Melvin, Mohler, and Schroeder, and Mr. Berliner and others who took an active part in this conference are in this room this afternoon. The well-known classification of milk suggested by Dr. Melvin was promulgated at that time. The prevailing opinion of the conference was for the pasteurization of the entire milk supply. In deference to the opinion of those who were not yet convinced of the advantages of pasteurization, the conference agreed to certified and inspected milk as being reasonably safe. To-day there is not a person who took part in that conference who does not advocate compulsory pasteurization of the entire milk supply. They will not, however, consent to the least abatement of rigid inspection at the farms and distributing depots.

The occurrence of the bacillus of infectious abortion in milk, first reported by Schroeder and Cotton in May, 1911, to the American Association of Medical Milk Commissions, in Philadelphia, and on which Theobald Smith and M. Fabyan published an article in January, 1912, is an additional argument for pasteurization, especially since there are now no known means to guard against the contamination of milk with this organism. The report of this conference is published in Circular 114, Bureau of Animal Industry, Department of Agriculture. The London Lancet, 1907 (Vol. II, pp. 936–937), in an editorial says that this circular was adopted as a textbook for the health offices of Great Britain.

On June 11, 1907, I requested Mr. Roosevelt, then President of the United States, to cause to be published by the Bureau of Public Health, the Department of Agriculture, and the health department of Washington, information upon milk from the farm to the consumer. This request resulted in the publication of Bulletin 41, Bureau of Public Health and Marine-Hospital Service, under the title of "Milk and its relation to the public health." A second edition, Bulletin 56, was issued in 1909. Circular 114 and Bulletins 41 and 56 have furnished the data for the greater portion of the regulations and legislation upon milk that have been enacted since 1907. The classification adopted for New York City and recently for Chicago are practically those recommended in these two publications. The classification adopted by the commission appointed by the New York Milk Committee is also practically the classification of the Washington Milk Conference of 1907.

It is interesting to note that the activities for the betterment of the milk supply of the country have followed those instituted in Washington between 1894 and 1907. The progress from 1894 to 1907 was great—that from 1907 to the present time has been marvelous.

Whilst Washington has not been able to secure much-needed legislation, splendid results have been secured from the campaign of education. Marked improvement in the production and distribution of milk has been secured. The press of Washington has continuously aided the movement.

This agitation in Washington has caused a marked reduction in the death rate from typhoid fever and the diarrheal diseases of children under 2 years of age. Each year more and better milk has been pasteurized. Each year the process has been improved.

Similar results have been observed throughout the country where like conditions have prevailed as to the improvement of the milk supply and the institution of proper pasteurization. The citation of a few figures will be interesting:

Deaths from typhoid fever per 100,000 population.

1894	79.0
1899	67.2
1904	43.6
1909	33.2
1910	23.2
1911	20.9

1912, January 1 to September 20, 312 cases, 30 deaths, in population of 350,000.

Deaths per 100,000 population, from diarrheal diseases, of children under 2 years old.

1894	190
1899	110
1904	103
1909	72
1910	81
1911	73

Total number of deaths from diarrheal diseases, of children under 2 years of age, from May 1 to Sept. 14.

1909	245
1910	205
1911	190
1912	130

Proper pasteurization means that milk should be raised to and held for a sufficient time at the temperature necessary to kill all pathogenic bacteria. Repeated investigation has demonstrated that this can be done at a temperature that in no way injures the chemical constituents or nutritive properties of milk so treated. Experience has demonstrated that this process must be conducted under intelligent official supervision. Experience has also taught that proper pasteurization can be secured by both the "holding" process and by pasteurization in the final container. In the final container with the metal cap—similar to that of the beer bottle—a greater number of bacteria of all kinds is destroyed. The so-called flash or instantaneous process should not be tolerated. It does not furnish security. What is said of milk applies to cream, ice cream, butter, and other dairy products.

DISCUSSION.

Mr. Oscar B. Schier, Baltimore, Md.: Every intelligent dairyman recognizes the superior method of capping milk bottles with the tin caps, and the advantage of pasteurizing milk under these caps in the final container, but, unfortunately, close investigation of this very desirable system shows that it is impossible to use at the present price of milk, since the price of the tin cap is about 15 times as great as that of the pulp cap used at present. This difference in our own dairy business would amount to nearly $6,000 a year.

There can be no doubt that the pasteurization of milk in bottles is most desirable, but again there will be found a large increase in the cost of carrying out this process over the present one, since it becomes necessary to heat, for every 32 ounces of milk in quart bottles, 26 ounces of glass, and for every 32 ounces of milk in pint bottles, 32 ounces of glass, and afterwards to extract the heat units from both glass and milk.

Mr. Rawl: A saving in the exchange of these heat units could be made by adopting a system of regeneration.

Mr. Schier: I agree with Mr. Rawl that the plan he mentions is an economic necessity, as proved by the fact that every intelligent dairyman depends upon this saving in using the principles of regeneration in the pasteurizing process as now carried out.

I would call attention to the fact that Mr. S. H. Ayers, bacteriologist of the Bureau of Animal Industry, has recognized, with others, that it is important to find means of pasteurizing milk in the present bottles under the caps now used as final containers. He has suggested that the milk be held for a period of from 15 to 20 minutes at the temperature of 145°, and then be filled into the bottles at this temperature, after which the bottles of milk should be held for 10 minutes at the temperature of 145°, then quickly cooled.

I myself have carried on experiments for some time on the same line, and find that the greatest difficulty of this system is that a drop of water might splash on the caps, and since, during the cooling, the volume of milk shrinks, and a partial vacuum is created under the caps, it is likely that this drop of water would be sucked into the bottles, recontaminating the milk with such bacteria as may be present in the water.

Therefore it has been for six years past my endeavor to find a method of preventing the possibility of any water splashing on the bottles while in the water bath, and I was glad to be able to announce that I had finally succeeded in doing so successfully, and that I hoped in the near future to build a commercial apparatus for this purpose. However, there still remains this theoretical objection to the process, namely, even if there enters no water into the bottles, due to the suction produced by the vacuum, the sealing of the bottles with the present caps is not sufficient to make the bottles air tight, and therefore the vacuum created by the cooling under the caps is gradually relieved by air entering the bottles through the joint between the cap and the bottle. However, the air in a well-kept dairy is as a rule not heavily laden with bacteria, and since the cap fits quite tight into the cap seat, this joint practically filters out any bacteria from the air; therefore the danger from this source of recontamination is negligible.

The advantage of not being compelled to discard the present equipment of bottles and apparatus, by being able to pasteurize in the present bottles, and with the present machinery, is so great that it is my belief that we must look in that direction for the solution of this problem. In the experiments made at our dairy we have tried to reduce the expense of this process by filling the bottles with the hot milk as they come from the sterilizer hot, saving the heat units stored in the glass by this sterilizing; but, even so, the experiments were absolutely conclusive that the expense of cooling milk in glass is very much greater for the cooling medium, as well as for the time in which to do it. Still the difference is almost nil compared with the expense of pasteurizing under the tin caps, the continuous cost of which is prohibitive, since it necessitates the purchase of entirely different bottles and new machinery.

Mrs. Wm. Lowell Putnam, chairman of the executive committee of the Massachusetts Milk Consumers' Association: The Massachusetts Milk Consumers' Association believes that the solution of the milk problem lies in associations of consumers, the larger the better; for if consumers unite, they can obtain anything they desire. What the public wants the public can get, whereas sanitary authorities are nearly powerless unless they have the public behind them.

These associations should aim at the purification of the whole milk supply, so that everyone will be able to buy clean milk. The association which I represent believes that the control of milk is primarily a health measure, and that this control should be exercised by a State-wide authority, for municipal health commissions can never adequately protect their constituents from impure milk. Milk excluded by them can readily sneak back in the form of ice cream and butter, or even as milk itself. A tariff system equal to the octroi of some European cities could not wholly prevent this.

A system of State inspection, under the State board of health, which would guarantee the quality of the milk, would be of as great benefit to producers as to consumers, for the laws which regulate other business are equally applicable to the milk business. The customer must be satisfied if the product is to be sold.

At present a little dirty milk is mixed with much that is clean, and the result is the contamination of the whole supply, with the consequent dissatisfaction of the public. The producer of clean milk must perforce be satisfied with the price which dirty milk will bring, for his clean milk has been made dirty by the mixture. Of course certified milk does not come under this rule, but that seems likely always to be too expensive to be within reach of the poor.

We must seek to bring ordinary milk to a standard of cleanliness which will make it a safe food and give up distributing a little selected milk to a limited number of babies. Milk stations are a confession of failure, either on the part of the legislature or the health authorities, or both; for if the laws and their enforcement were what they ought to be, these distributing stations would be unnecessary.

The question of price is involved in this matter of making the general milk supply clean and wholesome, and some of the elements of cost might be eliminated. One is the excessive waste in the present system of distribution, which has been so ably pointed out by Dr. Williams, of Rochester. My own belief is that if a cooperative system could be established between producer and consumer, eliminating the middleman and his profits, the price paid by the consumer would be reduced, and that paid to the producer increased. Dr. North has shown that sanitary milk can be produced at a very small increase of price by cooperation among farmers. I believe that cooperation is the key to the milk muddle. Into this cooperation the consumer must enter as never before. Hitherto the other factors have tried to solve the problem without the consumer's help, but without the consumer nothing can be accomplished, for he really holds the key to the situation.

The proceedings of the Joint Sessions of Sections VI and VII are found in Volume I, Part II.

SUBSECTION ON SEX HYGIENE

OFFICERS OF THE SUBSECTION ON SEX HYGIENE.

Chairman: Dr. PRINCE A. MORROW.
Vice Chairman: Dr. ROBERT N. WILLSON.
Secretary: Dr. DONALD R. HOOKER.

SECTION VI (SUBSECTION ON SEX HYGIENE). FRIDAY AFTERNOON, SEPTEMBER 27, 1912.

REPORT OF THE SECRETARY.

Dr. Prince A. Morrow,
President of the Subsection on Sex Hygiene.

Sir: I have the honor to submit an account of the meeting of the subsection on sex hygiene (subsection of Sec. VI) of the Fifteenth International Congress on Hygiene and Demography.

The meeting was called to order by the president, Dr. Prince A. Morrow, at 2 o'clock on Friday afternoon, September 27, 1912, in the Hall of the Americas, Pan American Building, Washington.

The following reports and papers were read:

Report of the Committee on Sex Education, by Thomas M. Balliet, Maurice E. Bigelow, and Prince A. Morrow.

Some Social Applications of Modern Principles of Heredity, by Dr. C. B. Davenport, biological laboratory, Cold Spring Harbor, N. Y.

An Outline Program of Practical Eugenics, by Dr. C. W. Saleeby, Edinburgh, Scotland. (Read by title.)

Status Praesens of the Prostitution Question, by Dr. Howard A. Kelly, professor of gynecological surgery in the Johns Hopkins University, Baltimore, Md.

Surgical Sterilization as a Eugenic Measure, by Bleecker Van Wagenen, South Orange, N. J.

Sex Education, by Maurice A. Bigelow, professor of biology, Teachers' College, Columbia University, New York City.

The following minute, proposed by Dr. William H. Welch, was adopted:

Whereas the Fifteenth International Congress on Hygiene and Demography marks an era in the progress of civilized nations in their intelligent foresight and care for the welfare of their citizens, and in no direction more visibly and positively than in the movement to establish a standard of moral and physical health for the two sexes; and

Whereas both the nations abroad and the American citizens at home recognize and pay tribute to the splendid devotion and service rendered by Dr. Prince A. Morrow in the difficult pioneer work of preparing the people for a knowledge that will enable them to safeguard their homes against influences hitherto unrecognized, misunderstood, or ignored: Be it

Resolved, That the participants in this section on sex hygiene of the Fifteenth International Congress on Hygiene and Demography consider it a privilege to make public record of their sense of obligation to Dr. Morrow for his courageous and unflinching attitude in the face of difficulties that would have discomfited an ordinary man and of admiration for the achievement that has culminated in the prominent position that education in sex hygiene has commanded in the deliberations of this congress; be it also

Resolved, That the delegates here assembled join with rare pleasure in this attempt, inadequate though it be, to express to Dr. Morrow the gratitude not only of the American people, but of the world of nations; and be it further

Resolved, That this minute be suitably engrossed, signed by the chairman and the secretary of this meeting, and presented to Dr. Morrow.

(Signed.) ——— ———.

WASHINGTON, D. C., *September 27, 1912.*

Respectfully submitted.

D. R. HOOKER,
Secretary of Subsection on Sex Hygiene.

REPORT OF THE COMMITTEE ON SEX EDUCATION.

To the AMERICAN FEDERATION FOR SEX HYGIENE:

In January last the undersigned, as a committee appointed by the federation to formulate a plan for sex education, sent out to a large number of educators and medical men a letter asking their opinion on—

1. The importance of educating young people in the physiology and hygiene of sex.
2. The practicability of introducing sex teaching into schools and colleges.
3. The matter and methods of the proposed instruction.

The replies to this inquiry, in the large majority of cases, were substantially favorable to these suggestions. Encouraged by this fact, your committee sought the judgment of experts on the main features of such instruction, both as to matter and method, and formulated 13 propositions outlining a possible scheme of such instruction, which were submitted for criticism to a large number of educators in schools, colleges, and universities, as well as to medical men and social workers. A little over 100 replies were received commenting upon some or all of these propositions. Many of these replies, in addition to expressing general approval, offered valuable criticisms which suggested modifications and additions. Some of these criticisms and suggestions are so important that your committee deem it desirable that they should be included in this report, and they are accordingly added in the form of an appendix grouped under the various propositions to which they specifically refer. Where the name of the author is given, it has been done with his special permission.

The replies in the case of each proposition have been classified under "affirmative," "negative," and "doubtful," to indicate in a general way the degree of approval.

In general harmony with the propositions referred to, and in the light of this body of expert opinion and criticism, your commttee venture to offer the following general outline of a plan of sex education.

1. Sex instruction has a purely practical aim, and should be strictly limited by this aim. Its purpose is to impart such knowledge of sex at each period in the child's life as may be necessary to preserve health, develop right thinking, and control conduct. Its aim is both hygienic and ethical, and whatever knowledge of sex and sex relations in human life is not necessary at any particular period of the child's life, for these ends, should not be imparted at that period. In all cases, however, temptations should be anticipated by the instruction necessary to protect the child from physical or moral harm.

A further aim of such instruction, not only to children but also to adults, is to develop a healthier public sentiment in regard to sex, which will make it possible to discuss, with more freedom than is now customary, the grave hygienic and moral dangers to the individual and the community which grow out of the violation of the physical and moral laws governing sex life and the sacred processes of human reproduction. The common reluctance of educated people, in the past, to tolerate discussion of this subject, outside of medical circles, must give way, and is rapidly giving way, to a nobler and purer sentiment which will recognize that whatever is fundamental and vital to health and morals in the individual and the community is a proper subject for serious thought and discreet discussion. Moreover, a knowledge of the marvelous processes by which life is perpetuated, from its lowest forms to its highest, impresses on the mind, more firmly than is possible in any other way, the sacredness of human reproduction and the dire consequences to future generations of wrong sexual conduct.

2. Sex instruction, thus limited in its aim, must differ in one important respect from other scientific instruction, in that it does not seek to create interest and awaken curiosity in the subject with which it deals, but merely to satisfy the curiosity which spontaneously arises in the child's mind, by answering his questions truthfully but only so completely as may be necessary to give proper guidance to his conduct, both hygienic and ethical. The less children and youth think of sex, and the later they mature sexually, the better both physiologically and ethically. Premature development of the sex consciousness and sex feelings is harmful.

Sex instruction, therefore, should aim to keep sex consciousness and sex emotions at the minimum, and should avoid everything which may tend to intensify either. Natural curiosity abates when judiciously gratified in a way not to suggest further inquiry. Children, like adults are curious, not about what they do know, but about what they do not know. In the later years of adolescence, however, such instruction may properly suggest the vast hygienic and ethical implications in the facts of sex and of reproduction. It is important also to satisfy all normal sex curiosity before it becomes reenforced by the development of adolescence of the sex emotions, and to anticipate the possibility of the child's receiving sex information from impure sources.

3. It follows from the above principles that detailed descriptions of external human anatomy are to be avoided, and that descriptions of internal anatomy should be limited to what is necessary to make clear and to impress the hygienic bearing of the facts to be taught. The details of human embryology which have no direct bearing on important practical truths should likewise be avoided. In printed books and leaflets, cuts illustrating human anatomy should be avoided wherever possible, and, if used at all, should be limited to the absolutely essential facts and should be conventionalized for the purpose as much as scientific accuracy will permit.

It is both important and timely, in the judgment of your committee, that the federation should emphasize the necessity of wisdom and good judgment in imparting sex instruction and in the publication of booklets and leaflets on the subject. Danger to the movement might conceivably come from lack of judgment or overzeal on the part of its friends.

4. The purely scientific basis for such instruction must be laid in the biological nature study in elementary schools and in the more systematic instruction in biology and hygiene in secondary schools and colleges.

It must be supplemented by providing proper physical exercise; by insisting in the home on regular hours of sleep; by providing adequate facilities for play and wholesome amusements; by protecting children from the unwholesome associations and corrupting influences of debasing shows and immoral literature; and by maintaining the confidence of children in their parents and teachers, so that signs of danger may be the more promptly detected.

6. The purely scientific instruction must be reenforced as strongly as possible by ethical instruction, both direct and indirect, with due regard to the maturity of those taught. Such instruction should be incorporated in the general course in practical ethics in secondary schools and colleges; and certain phases of it should be made a part

of the general lessons in morals in the upper classes of the elementary schools. Effective appeals can be made to the sense of personal self-respect and purity, and to the instinct of chivalry, in the earliest years of adolescence, or even before. With relatively mature students, the vast sociological bearings of the subject, with their ethical implications, can be utilized effectively.

Among the means of indirect ethical instruction for this purpose, the most effective is good literature. It is of immense consequence that during the adolescent years the pupils' minds be saturated with the great masterpieces, both in poetry and prose, which deal with romantic love in its purest forms. Thought of sex and sex emotion must at this time be spiritualized and placed on the highest plane, and good literature is the most effective means to this end which is available in the public schools. Any kind of sex education which ignores the education of the emotions is seriously defective. Deep intellectual interests, enthusiasm in art, or ardent devotion to some worthy practical cause, absorb the mind and furnish wholesome avenues for the expression of the emotions. Few conditions are so dangerous at this period as idleness, either physical or mental, and an absence of interest in things which appeal to the higher altruistic instincts.

The value of physical exercise, especially in the form of play and athletic sport, in its bearing on the control of the sex instinct, is so generally recognized that it needs no special emphasis here.

8. For the purpose of outlining more specifically the character of the instruction adapted to various ages, the life of the pupil may be divided conveniently into four periods, namely, from 1 to 6, from 6 to 12, from 12 to 16, and from 16 years to full maturity. This division, as will be recognized, is not wholly arbitrary, but rests upon a basis of facts, both physiological and psychological.

The period from 1 to 6 years is the period preceding admission to school, and is therefore the only period during which the care of the child falls chiefly upon the mother, the kindergarten at present reaching only a small proportion of children. It is therefore important that in lectures on sex education given to mothers, special emphasis be laid upon this period, and that proper instruction be given as to the care of the child's body. The danger to the child of placing it in the care of an immature or injudicious nurse should be pointed out. Instruction should be given as to how the child's questions relating to the origin of human life may best be answered. This is the only sex instruction a child needs during this first period. Watchfulness over the child's habits and protection from untoward influences constitutes the mother's chief duty.

10. The period from 6 to 12 years, which might be subdivided into that of early childhood and that of later childhood, covers the greater

part of the elementary school period. Here the school must share with the home the hygienic and moral care of the child; and as most parents are not qualified at present to give the necessary sex instruction to their children, this duty falls mainly upon the school.

Truthful and delicate answering of the child's questions as to the origin of the individual human life, and instruction which will protect it from forming injurious sexual habits, constitute the chief features of sex instruction during the early years of this period. Such instruction at this period is best given privately and should be carefully adapted to the child's individual needs.

It is essential at this, as at other periods, that the child be provided with abundant facilities for play and exercise; that his habits of sleep be regular; and that he be protected from corrupting social influences at school and in the neighborhood.

In addition to the above, there should be given, during the years of later childhood, including the remaining years of the ordinary elementary school course, a carefully planned series of lessons on reproduction in plants, as a part of the course in nature study. The child should be made to understand the function of root, leaf, flower, and seed; the different modes of scattering seeds; the various methods of fertilization, and the necessity of fertilization; and he should be led up to the generalization that plant life always springs from plant life.

In like manner a series of lessons on reproduction in animal life below mammals should be given, making use of familiar animals. The origin of the chick, the fish, the frog from the egg, and the metamorphosis of the frog; the origin of insects; and, finally, the necessity for fertilization—these might form the chief general topics of such a series of lessons.

The aim should be, so far as specific sex instruction is concerned, to deeply impress the mind of the child with the beautiful and marvelous processes of nature by which life is reproduced from life, both in the plant world and in the animal world. It is not necessary, and in most cases not desirable, that children should make an application of this knowledge to reproduction in man before the beginning of adolescence, further than that human life comes chiefly from the mother. But such instruction on reproduction in nature will create the background of knowledge which will afterwards invest reproduction in the higher animals and in man with a significance and dignity not otherwise attainable; and, what is equally important, it will create the right emotional attitude toward human reproduction and prepare the child's mind to appreciate its sacredness.

During the last three years of the elementary school course overage children and children who have contracted injurious sex habits often need instruction of a special kind in addition to the above. Such instruction should always be given privately.

11. During the early adolescent period, approximately from the age of 12 to 16, reproduction in plant and animals below the mammal should be more extensively studied, and the wonderful variety of modes of fertilization, especially in plants, should be emphasized. It is important to make the pupil acquainted with a wide range of facts, in order to impress his mind with the wondrous beauty of nature's provision for the perpetuation of life, the aim being always ethical as well as scientific and hygienic.

With this background of knowledge reproduction in mammals may be taken up. The teaching ought now to impress, with many illustrative facts, the generalization that all life comes from the ovum. Fertilization in mammals should now be taught, and this should lead by natural steps up to reproduction in man. The simplest facts in regard to heredity should now be taught, and their applications be made to animal and to human life. The pupils will then be in a position to understand the significance of sexual morality, and to be impressed with the dangers to health and morals of abnormal sexual habits. Specific instruction in regard to sexual morality will now be especially effective.

As girls mature from a year to a year and a half earlier than boys, they should receive instruction somewhat earlier than boys in regard to the special care of their health at the change of life called "puberty."

In connection with the study of reproduction, both during the earlier and the later adolescent periods, emphasis should be laid on the broader ethical implications of biological facts, as facts revealed in evolution. The evolution of care for the young, of the corresponding psychic factor of love of offspring, should be made clear and emphatic. The evolution of parental love should be traced both in animals and in man. The fact that as the offspring are fewer and are more helpless at birth, parental love and care must of necessity increase; that the pairing of animals for this purpose foreshadows the human family; that as the human infant is one of the most helpless animals at birth and has a long period of maturing, human parental love is naturally strongest, especially in the mother. At this point biology and ethics are so closely interrelated that they can be made mutually to reenforce one another, and the significance of the family and the sacredness of the home can be impressed as in no other way that is available in the public schools.

The ethical relations of the home between parents and children and between brothers and sisters should be emphasized. It should be impressed upon every boy that every girl is somebody's daughter and usually somebody's sister, and that it is his sacred duty to accord her the same respect and protection which he would exact from another boy toward his own sister. It has been found by actual experience that this point of view can be made to appeal strongly even to boys to whom some other points of view do not appeal effectively.

13. During the entire period of adolescence children should be given a general knowledge not only of the physical changes through which they are passing and their hygienic and ethical significance, but they should also be led to comprehend the significant psychic, especially the emotional, changes through which they are passing. At this time children are at times a mystery to themselves, and are apt to feel that they are not understood or are misunderstood by their elders. If at this period parents do not maintain close sympathetic and confidential relations with them, there often result alienation of the children and loss of control by the parents.

14. During the entire adolescent period, in addition to the indirect moral training through literature, as suggested above, there should be systematic instruction in practical ethics, of which the ethics of the sex relation should form a natural and integral part.

15. During the later period of adolescence, that is, from the age of about 16 to complete maturity, there should be given, in addition to the foregoing, more thorough instruction in heredity and the bearing of sexual morality and immorality on future generations, and special instruction as to the character and the dangers of venereal diseases. While in individual cases such instruction is sometimes needed earlier and should be given privately, the general presentation of the subject should be reserved until later adolescence, on the general principle that any particular phase of sex instruction should be given only when it is needed to protect from real harm.

16. It is not desirable that there should be specially set lessons in sex instruction in schools, but such instruction, in all but exceptional cases, should form a natural part of the course in nature study, biology, hygiene, and ethics.

17. All instruction in reproduction in plants and in animals below mammals can be given in coeducational classes. Instruction in reproduction in mammals may best be given in separate classes; and instruction in human reproduction should always be given in separate classes, and each class should be taught by a teacher of its own sex.

18. If certain pupils need instruction beyond the needs of the class as a whole, such instruction should in all cases be given privately. The extent to which general instruction in human reproduction and sexual morality may with advantage be given in class instead of privately depends so much on the character and maturity of the class and on the personality of the teacher that no general rule can be

laid down. It must be left largely to the tact and judgment of the teacher.

19. While sex instruction in human life should not be attempted by all teachers but should be given by those who have special qualification for it, both personal and academic, it is not desirable that any teacher should make a specialty of this type of instruction and of no other. We do not want "sex specialists" any more than we want special courses in sex instruction detached from the courses in science and ethics, of which they naturally form an integral part. All that should be demanded of such a teacher is that he should have a thorough and accurate knowledge of the scientific facts involved and possess the personal qualities and the teaching tact and skill necessary for effectively presenting the subject. Other things being equal, it is better that one of the regular corps of teachers in the elementary schools, whom the pupils personally know and who has a firm moral hold on them, should give this instruction, rather than that a specialist, who is a stranger, should come in and be known to the pupils as the teacher of this subject alone. In secondary schools and in colleges such instruction would naturally be given by the teachers of biology, of hygiene, and of ethics.

20. In order that some teachers possessing the necessary personal qualifications may be trained to give this instruction, and in order that all teachers may have such general knowledge of it as to be in intelligent sympathy with special teachers and lend them their support, all normal schools and all departments of education in colleges and universities should provide the necessary courses to meet this need.

21. As many pupils do not enter a secondary school, or even complete the course in the elementary schools, it is essential that sex instruction be given in the regular evening schools which such pupils now generally attended in most cities of the country. Such instruction in evening schools, because of the shortness of the term of such schools, may profitably emphasize the human and most vital aspects of the subject somewhat at the expense of its broader biological treatment. It is essential that such instruction cover the topics of most vital importance to the pupil, and not stop short of that by devoting too much of the limited time to more or less preliminary topics. It is needless to add that for purposes of this instruction students must be classified according to age and not according to general scholarship.

22. As parents should naturally give much of this instruction to their own children, and as comparatively few of them are qualified to give it, systematic courses of lectures should be provided for them at public expense.

22. Courses in sex instruction, carefully adapted to the age of those taught, should be organized in Young Men's Christian Associations and in various types of boys' clubs; such classes have in fact been formed in many such associations and clubs.

In conclusion, your committee would emphasize the necessity of good judgment and tact in introducing sex instruction into schools. It should not be introduced prematurely, but only so fast as teachers can be found or trained who are competent to give it, and so fast as public sentiment will support it. On the other hand, undue weight must not be given to the difficulties, even under present conditions, attending such instruction, inasmuch as even occasional mistakes will do far less harm than allowing children to continue to gain this knowledge, as many of them now do, from impure sources, which induces in them an attitude of mind toward the subject that makes it extremely difficult to give them later the best instruction. In not a few such cases subsequent sound teaching is practically fruitless.

Respectfully submitted.

Thomas M. Balliet,
Maurice E. Bigelow,
Prince A. Morrow,
Committee.

SOME SOCIAL APPLICATIONS OF MODERN PRINCIPLES OF HEREDITY.

Dr. Charles B. Davenport, Carnegie Institution of Washington, Cold Spring Harbor, N. Y.

The modern studies in heredity have made that science relatively simple. In the first place, no trait, as we know it in the body, is inherited, but some thing or things in the germ cells that stand for it and, under appropriate conditions, will develop into it. The determiners only of traits are inherited. Secondly, strictly we do not inherit from our parents; but parent and child get their determiners from the same germ plasm, just as two successive leaves of a tree are derived from the same substance of the growing tip. Sexual reproduction complicates the comparison; the son is a younger half-brother to his father by a different mother. Thirdly, many traits, as we know them, are composed of from several to many unit characters, each of which is due either to the presence of a determiner, or to its absence. Thus the pigmentation of the full-blooded West Coast African negro is due to four determiners. But the long hair of Angora sheep, rabbits, and so forth, is due to the absence of that determiner which early stops the growth of the hair. So brown eyes are due to a determiner for iris pigmentation, but blue eyes are due to the absence of such a determiner, so that the normal blue background of the eye remains exposed.

When the germ cells of both parents carry the determiner for a character then in the fertilized egg (and the child that develops from it) the determiner for that character will be double, and every germ cell carried by that child at maturity will have a determiner for the character. But if, on the other hand, one parent only has the determiner for a given character while the other lacks it, then the child will have only a single determiner for the given character, and on maturing only half of the ripe germ cells will contain the determiner in question. Now, if in each parent only every other germ cell has the given determiner, and if the union of germ cells takes place at random, then in four haphazard unions the two uniting germ cells will bring to the zygote two determiners in one case, only one determiner in two cases, and no determiner at all in one case. In three children the trait will usually appear, but weak in two of the three, and it will not appear at all in the remaining case.

The determiner is not the character. In order to become such, it must develop. And the course of its development is determined by external as well as internal factors. This is where environment plays a part to provide the best conditions for the development of embryonic traits.

So much for the principles of heredity; now for their social applications. The social applications depend on the fact that many of the physical and mental traits of man, all of which have an hereditary basis, have a social significance. Whether a man has straight hair or curly probably has no such significance; whether he is tall or short has some; whether he is deaf or not, still more; whether capable of self-control in various respects or not, still more. Now these socially important traits the man has "through heredity"; and, by virtue of the same principle, his descendants may, under certain circumstances will, have them also. Persons with socially desirable traits belong to strains which, by appropriate and fecund matings, are continued through the generations, and yield valuable progeny. Persons with socially undesirable traits belong to strains which, by certain matings, if fecund, are continued through the generations and yield socially harmful progeny. Social progress is largely, if not chiefly, due to socially proper and fecund matings. Social decline is largely, if not chiefly, due to socially undesirable fecund matings. Just because society has abandoned the control of matings but still maintains its right to control conditions of nurture of the individual, society is trying to deceive itself into the belief that improved nurture can take the place of deficiencies in breeding. And so this congress meets this week, largely inspired by this confidence. Vain hope! You may paint out the leopard's spots, but her cubs will have them just the same. And, while you are reducing the death rate from tuberculosis in this generation, you are spoiling nature's beneficent work of the past, so that, after man has finished with his meddlesome interference, she will have to do it all over again. For the high death rate from tuberculosis in the early years of New England had left the old stock a highly resistant race. But now we are saving those with the consumptive diathesis to use as breeders of the next generation. You may listen to the student of heredity or not; but he tells you, without a shade of hesitation, that permanent social improvement is got only by better breeding.

So much in general. Let us now consider what is known about the sorts of matings that are responsible for certain socially undesirable progeny, for our information is becoming precise on this subject. Let us consider feeble-mindedness, epilepsy, insanity, criminality, prostitution.

Feeble-mindedness is a purely social term. The feeble-minded are socially inadequate. It takes a lot of time and money to care for them, since they can not properly take care of themselves; the period of infancy is prolonged throughout life. There are different types of feeble-mindedness. But if the clear cases of imbecility are alone taken—cases of general failure of mental development—then the following rule seems to hold: If both parents lack the determiner or determiners for complete mental development, then all of the children will lack them. It might seem, a priori, improbable that such a mating would take place. But, on the contrary, it is the usual thing. It is the half-witted farm hand who goes to the poorhouse and asks the superintendent to let him have a certain imbecile girl to marry; and not infrequently the superintendent thinks he has done the town a service by relieving it of the expense of maintaining the girl. He has, however, really started the pair to breeding imbeciles for his successor to take care of, and his successor will ask the town to make a large addition to the poorhouse and to the budget for maintenance.

Epilepsy is due to a brain defect that allies it to imbecility. Two epileptic parents have only epileptic or feeble-minded or otherwise neurotic, offspring. Twenty-seven matings of this sort, or of epileptics and the feeble-minded, have, in the studies so far made at Skillman, N. J., yielded 43 epileptics, 58 feeble-minded, 1 insane, 2 migrainous, 8 neurotic, and none nervously normal. These conditions, as is well known, are not curable. The number of permanently neuropathic offspring of such matings more than doubled in one generation.

Insanity is another social term. The types that have been best studied from the point of view of family history are the " functional " ones. These types—the manic depressive and dementia precox—are probably the socially most important, as violence and delusions of persecution are most apt to appear in them. Two insane parents of these types have only insane offspring. There is something lacking in the germ plasm that is required for neural strength. To stop the stream of the functional insane, stop breeding them.

Crime is another social term. The elements that go to make a person do "criminally" antisocial acts have not yet been analyzed, but, so far as the subject has been studied, it seems probable that in many cases there is an absence of inhibitors in both parental germ plasms, and that this defect is bred.

Prostitution is usually ascribed solely to extrinsic factors, e. g., to wages insufficient to maintain the body. Evidence is accumulating to show that the primary factor is an inherited predisposition toward an exceptionally active sexual life. The mercenary return is a not unwelcome accompaniment, and serves as the excuse sufficient to hide from the unanalytical inquirer the true weakness of the delinquent. In this antisocial conduct, such studies as I have been able to make, tend to the conclusion that the heightened licentiousness is favored by an additional germinal determiner that less licentious persons do not have. Of 350 girls, there was but 1 in this life for economic reasons.

It will be seen, from the foregoing illustrations, that the hereditary basis of some social traits is absence of a corresponding determiner in the germ plasm; while, in other cases, it is the presence of an extra undesirable determiner. The social difference of these two classes of traits is very great. Thus, persons with positive antisocial traits will transmit this condition to half of their progeny; and they ought not to have children. But most of the antisocial conditions are due to the absence of a determiner. A person whose germ cells carry the defect may or may not know it; for, if he be simplex, he will appear normal even while carrying defective germ cells. Only if he lack the determiner altogether will he appear defective. No doubt it were better for the race that a grossly defective person should not marry; but, if he marries, let him marry into a strain that has not the defect. Then his children will not show the defect, though their germ cells carry it. As for the imbecile, he will not be controlled in his mating by reason or law and, so long as he is at liberty, he will have children by imbeciles of the opposite sex. The only way to stop the reproduction of imbeciles is to sterilize or segregate them; the latter, though more expensive, is the more thoroughgoing. Thus, and thus only, may society, now that it has entered on the policy of protecting the imbecile, protect itself from being swamped by the differential fecundity of the unfit.

Thus we see that the heavy expense society is under in caring for the socially inadequate is a consequence of bad breeding. Is it not time that society undertook to educate the normal young as to proper marriage selection, and to restrain the neuropathic young from reproduction? If this is done, the work of hygiene will be simplified, and the present menace that hygiene offers to the race will be diminished.

AN OUTLINE PROGRAM OF PRACTICAL EUGENICS.

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Eugenics, or good breeding, was conceived and named by my master, the late Sir Francis Galton, as increased fertility of superior stocks. Modern research, above all in genetics, based upon the work of Mendel, which was unknown when Galton began his work, has taught us the immense difficulty of Galtonian eugenics, the doubtfulness of its assumptions as to stocks, and the necessity for analysis of individuals, even within a given family, as in the case of Mendel's peas, for brothers and sisters may be as un "like as two peas" were found to be by Mendel.

Modern biology, also, qualifies our theory of "natural selection," which meant so much to the nineteenth century. In any case, it is an abominable and contemptible pervision of Darwinism to call the action of the slum and the public house "natural selection." The slum and the public house are not natural. Eugenics must beware of those who would thus mislead its young steps.

When we come to practice, the following necessities seem clear: Every new life, from conception, should have proper nurture; worthy parenthood should be encouraged, unworthy parenthood discouraged; and worthy individuals should be protected from the racial poisons which would make them parentally unworthy.

Hence I formulate the following:

A. *Primary or natural eugenics.*—(1) Positive—the encouragement of worthy parenthood. (2) Negative—the discouragement of unworthy parenthood. (3) Preventive—the exclusion of the "racial poisons," by which I mean alcohol, lead, syphilis, and any other agents that may hereafter be proved to damage the germ plasm.

B. *Secondary or nurtural eugenics.*—The provision of a right environment for the new life from conception onward.

All the rest is the application of the foregoing. I would only note, under positive eugenics, that we must practice, above all, education for parenthood; under negative eugenics, that the feeble-minded are the chief part of this problem, immensely simplified for us by the recent work of the American Eugenics Record Office; under preventive eugenics, that the blastophthoria or germ damage produced by alcohol has now been microscopically demonstrated; and as regards nurture, that it must begin at the beginning, which means the care of expectant motherhood as never yet in history outside the ranks of Judaism.

STATUS PRAESENS OF THE PROSTITUTION QUESTION.

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I. ALL THE NECESSARY INVESTIGATIONS HAVE BEEN MADE.

Prostitution is the burning question of this, as it has been of every preceding, age. In planning to attack this great plague by modern methods, we have done right to spend much time in thoroughgoing preliminary investigations prefatory to any strategic movement with a view of abating or abolishing existing conditions. The results appear in several excellent reports from New York, Chicago, Portland, Oreg., and Minneapolis, while some nine other cities are at present making investigations. The interest in the prostitution question is, then, manifestly nation wide, and you can scarcely find any intelligent person who has not been thinking about it and who is not seeking information and advice.

The investigations show that the conditions here, in Europe, and everywhere are pretty much the same, varying slightly with local conditions and the varying corruptibility of the police force coupled with indifference or cooperation of the judiciary.

The evidence is incontrovertible, and wherever prostitution is tolerated there is national decadence. In my opinion, we have but little to expect from further investigations, which can furnish data of value only to those who are dealing with local questions and demanding facts to go upon. No worker in the field expects, I am safe in saying, that any new discoveries will be made or any material change in the problem result from more committee work outside of the as yet undetermined educational problem.

Investigation has shown us that the cost of immorality to the country at large constitutes an enormous waste of hundreds of millions of dollars, added to the combined totals of our appalling national liquor and tobacco bills. But investigations can not reveal or tabulate, or even faintly suggest, the infinite loss in the incalculable sum of human suffering, sorrow, misery, degradation, disappointed hopes, family tragedies; it can not sum up the wrecked lives of several millions of men and women and children nor the enormous and increasing sterility, which alone is alarming from the standpoint of national conservation.

Numerous investigators have shown that among the costs of a tolerated prostitution we have to reckon from 70 to 80 per cent of all the blindness which begins in early childhood.

The extreme contagiousness of gonorrhea has been shown in a generation extending from Max Sänger's work, in the eighties, down to the investigations made in the Hebrew asylum, of New York, in 1896, where 65 cases of infection in children were traceable to one source.

We see "syphilis representing the most potent factor in the degeneration of the race, absolutely extinguishing the productivity of certain families."

We know that "the portion of nonpremeditated childless marriages due to the husband's incapacity from gonorrhea varies from 17 to 25 per cent and that 75 per cent of sterility in married life is not of choice, but is due to the incapacity of the husband." (Morrow.)

The relative frequence of these diseases, the concomitants of illicit intercourse, in a single city (New York) was found by the committee of seven appointed by the Medical Society of the County of New York in 1901 to be: New cases of gonorrhea and syphilis, 243,000; old and new cases together, 800,000. That is to say, that about one in every five persons in the community are infected. As a matter of fact, the exact figures are immaterial, for we could not appreciate the awfulness of the evil if it were only one-tenth the amount. We now know certainly what was only suspected a generation ago, namely, that most of the locomotor ataxias are due to syphilis (90 per cent in all cases) and that a large percentage of all insanity is attributable to this cause, as well as a long list of apoplexies and paralyses.

Investigation has shown that the overwhelming percentage of cases of syphilis and gonorrhea (74 per cent), as observed in several dispensaries and in private practice, is due to the public prostitute. (Bierhoff.)

We are also aware that houses of prostitution are everywhere associated sooner or later with the utmost official corruption; that officers of the law, doctors, and politicians, as well as the manufacturers of distilled and malt liquors, make enormous profits from the traffic. (Brussels, Vienna, New York, and elsewhere.)

As a fair sample of the debauchery of the medical profession entailed, I hold in my hand several cards which came into my possession to-day, signed by a doctor living on East Baltimore Street, in Baltimore, which certify that the prostitute named on the card "is clean and free from disease." The method by which this doctor arrives at his scientific conclusion is to enter the prostitute's room, sign a card, stick it in the corner of the mirror frame, and collect a dollar from the inmate; no inspection; no microscope; one consideration, and that one paramount, the dollar.

We know also that the profits from commercialized vice are so colossal, and willing women victims so scarce, that the bawdyhouse keepers, pimps, saloons, and often the police themselves, conspire to decoy innocent girls, by marriage or on other plausible pretext, to ravish them under intoxication, to beat and bruise them, often to batter them into insensibility, and sometimes to kill them, without heeding the screams of terror and of outraged virtue, without pity for the tears of these helpless, unprotected children. By these measures they seek to force them into a life of common prostitution and a willingness to receive the visits of any number of men a night, irrespective of their physical or personal condition, of filth or disease. And beyond, even beyond this, are depths of degradation into which many are dragged, at which I can not even hint. (See Jane Addams's "New Conscience and an Ancient Evil"; Clifford Roe's "Panders and Their White Slaves"; and Kauffman's "The House of Bondage.")

We know, and we need no added proofs to demonstrate the fact, that there exists a vast army of vile creatures, called pimps, panders, and macks, the most degraded of all human beings, who enslave and then fatten on the lifeblood of their helpless girl victims; girls who, after a few short years of sexual debauchery, drunkenness, and drug intoxication, are dumped on to the street to drop yet lower or to be gathered into almshouses or hospitals to die. The average prostitute is variously estimated as living from five to seven years.

We know by indisputable facts that wherever prostitution is allowed to go on unchecked we must reckon as an offshoot upon a definite percentage of disgusting depravity of other sorts, such as the abuse of man with man (sodomy); men of this character can even be found soliciting in the streets of our large cities. We have but recently caught a number in Baltimore.

We know well that, as a regular offshoot from tolerated vice, in every community in our land a definite, ascertainable percentage of little children are violently taken—snatched sometimes from the very cradle itself, the shelter of harmless innocence—and ravished and infected with either syphilis or gonorrhea, or both.

Dr. Flora Pollack, in my clinic at the Johns Hopkins Hospital, has had over 200 such cases, and reckons about 500 of these little victims yearly for the city of Baltimore, with an added 500 for the State of Maryland at large. The Chicago Vice Commission reports that, during a period of 27 months, 600 infected children under 12 went through the wards of one hospital (Cook County), of whom 60 per cent had been innocently infected, 20 per cent had inherited disease, and 25 per cent were the victims of assault; 15 per cent had syphilis, and 85 per cent gonorrhea. Who can pretend to even the faintest realization of the sorrow, suffering, and degradation involved in these bare statements?

We know the world in which we live in a new way within the last 30 years, and the greatest discovery, most potent for our weal or woe, which we have made has been the recognition of the fact that it is only in Christian countries that women are duly honored and children cherished. Wherever the prostitute flourishes and women are in any degree the slaves or tools of man there Christianity is nominal, and there is a drop toward the level of the unspeakable degradation of China, of India, or Arabia, and of Africa. It is a fixed law that the more we exalt our women, the more we advance in the arts of true civilization.

It seems almost absurd to have to formulate so palpable a truth, so evidently is the woman, as the Bible has declared, of one flesh with her husband, and how can a man abuse his own flesh and not suffer for it? Yet this is the great folly of the ages.

In view of all these well-known, awful facts thus barely outlined the statistical side of this question may indeed be said to have been well worked out, and I confidently aver that it is but a waste of labor to adduce further data. I, therefore, request that our various social and hygienic societies will discourage further efforts on these lines as wasted time, and not likely to prove of more than local interest.

II. CAUSES OF PROSTITUTION AND ITS DISEASES.

Knowing all these facts, the next logical step was to discover the causes of modern prostitution and its associated diseases. This side of the question has also been worked out and with the same degree of satisfying definiteness. The various causes are now so well known that I will only state broadly and categorically some of the conclusions—what are and what are not causes.

First of all, prostitution, as it exists in our midst, does not spring from a natural proneness of women toward vice. The prostitute herself, however degraded she may become after she has taken the initial steps, is a product and not a cause of anything, except in so far as she transmits contagious diseases grafted on her person by prostitute men; nor is the despised pimp the real cause of the prostitute, however justly punished when plying his damnable traffic; nor yet again is the madam, nor are the police officers who tolerate the houses and graft on the inmates and on the streetwalkers, though they must bear their share of blame for malfeasance.

We draw nearer to the true source when we discover that many girls are driven to a life of shame by the low wages paid in some department stores and in many factories. The blame, the cause of all causes, the causa causans, lies wholly on the shoulders of the indifferent public, upon our churches and our religious professors, whose age-long ignorance of the facts is but added proof of neglected opportunities and of guilt. The guilt springs from the complete separation and loss of community of interests of rich and poor, from divisions of society into classes without mutual interests; classes which tend rather to live in armed camps, ever ready for fratricidal hostilities. I believe that the sins of omission of the wealthy, the educated, and the leisure classes are greater than all the sins of commission cited above.

"Dr. Kelly," said a charming woman to me the other day in Detroit, "I can hardly believe such awful things are true. It is worse than anything I ever heard of." "Yes," I commented inaudibly, "there is one thing far worse, and that is the indifference of our people and of our churches."

In immorality and its necessary concomitant, disease, the poor man takes poetic justic on the rich by infecting his son and rendering him childless, so that in a generation or two the poor man steps into the rich man's property, too soon, in his own turn, to pay a like penalty to the poor of his own day.

We are reaping the harvest of the distressing social surroundings of the disinherited poor, robbed of their inalienable birthright to an opportunity to make an honest living, to live a good life happily in healthy homes, to enjoy a daily modicum of recreation, and to provide comfortably for the necessities of age. These causes lie in the injustice of our industrial conditions, in many of our sweatshops, and in our stores and factories, where the faces of the poor are ground off by the rich. They lie in housing conditions, by which we rob the poor of all privacy and make cleanliness impossible. In the tenements and the alleys they cry in vain for air, for light, for water, and for provisions for decency and privacy in attending to the necessary functions of the body. Need we look further and consider our filthy streets, the small courts, and poor little tots driven to get exercise and play their games in our dirty, dusty, asphalt highways, in absence of proper playgrounds; shall we follow them as they grow up but gravitate down to the low amusements provided to harvest their nickels, to the saloons, the dance halls, and the Sunday parks outside the city, and then down into a life of crime or immorality? Let me insist here also that, unless new causes are found, our time is misspent in going deeper into the causative side of this great practical question. We surely have but one reason for wanting to know the causes of prostitution, and that is to discover the right lines for intelligent, aggressive action. Inasmuch, therefore, as we do now know the various causes, the next logical step is manifest.

III. THE TREATMENT OF PROSTITUTION IS A LIFE WORK ON THE FOLLOWING LINES.

The problem has been approached in two ways:

(*a*) From the standpoint of the diseases which invariably accompany prostitution, and the effort to wipe them out.

(*b*) From the standpoint of the immorality involved in the promiscuity of the sexes; that is, the moral or the ethical side.

If I read the signs of the times aright, there is a tendency in some parts of the world, which is even national, to deal solely with the question of the destructive diseases allied to prostitution as its very hall marks, neglecting the moral aspect as something personal and impossible to reach. The tacit assumption seems to be that if only the diseases can be eliminated, the question may then be considered as settled. My absolute and unalterable conviction is that, in one sense (let me not be misunderstood), the diseases are a boon, in that they have at last compelled us to rivet our attention upon this unwelcome subject. I believe that if we could in an instant eradicate the diseases, we would also forget at once and forever the moral side of the question, and would then, in one short generation, fall wholly under the dominion of our animal passions, becoming grossly and universally immoral, ruled by the love of gain, untrustworthy, truce breakers, pusillanimous, and a ready prey of any little nation ruled by real men, disciplined in the lessons of self-control.

I therefore protest and, for my own part, absolutely refuse to deal with the question of the diseases apart from the far more important and serious moral issues involved, except in so far as my worthy friends may elect to divide and specialize their fields of work, including the diseases as a part of the treatment of the whole subject.

The burning question with regard to a young man or a young woman who is a sinner is not, Has he or has she contracted gonorrhea, but has he or she lost the standard of purity and the lesson of self-control, and so lost the best boon life can confer on any of us. How priceless the value to the nation of the men and the women who have retained these high standards; alas, it is they and they alone who are capable of measuring the loss, for with the loss comes moral blindness.

Let me also lay an old ghost, ever popping up and pretending to be lively and scaring a lot of uninformed, untutored children. The name of that ghost is "segregation." Every man who has read nothing but the newspapers, and who culls his opinions from chance talks with his fellows in the club, naturally thinks that segregation is just the one clever and original way to handle prostitution. One of them eagerly and graphically described it to me two days ago, gesticulating and spreading his arms in a circle and then drawing them in, to show me how he "would corral all the prostitutes in one little section of the city, and keep them there, and put them in hospitals if they were diseased, and punish them severely if they were too obtrusive." And so easily was the great question settled, labeled, and put away on the shelf.

Alas! the "best-laid plans gang aft a-gley," and this one, too, has been tried for centuries, notably, during the past century on the continent of Europe, and it has been so clearly shown that it does not work, and that by it all the worst evils of prostitution are fostered, propagated, and fastened on the community. Segregation does not segregate more than 1 in 10 of the women. Even if it worked ideally in controlling the women, it has never even pretended to control the men who are the porters, the active agents in carrying the infection from house to house, and, for this reason alone, it is a logical folly. It is also inseparably bound up with graft and official corruption. Segregation does not work, therefore, because it never has existed except in name, a name which is conjured up as a ruse by the ignorant to avoid intelligent discussion of the subject.

What method of treatment, then, will prove effective? First of all, let me insist broadly that prostitution must be attacked from every possible standpoint, at all times, and by men and women who have not gone into the matter simply "to clean up the city," but who are determined to make this their life work, their one great object in living; an object to be handed down, more precious than any material, earthly heritage, to worthy successors, who, in their turn, will carry it on in the next generation. You will perhaps hear me with better grace if I tell you, as a concrete example of the way to solve the problem, how we are working in Baltimore.

First, we learn the facts; then our plan is to proceed against the owners of the bawdy houses, and to compel them to eject their law-breaking tenants after due notice. Before breaking up such a community we offer aid to every inmate willing to leave the life and accept it. Naturally, the inmates first attempt to scatter through the city. We then follow them up, prostitutes as well as keepers of low houses, wherever they hide in other parts of the city, and we attack them there and drive them out, to Philadelphia or New York, or any other city not wise enough to protect itself. We hale panderers into court, and secure long sentences for them; we cooperate with the United States Government in cases of pandering involving the interstate law. We are constantly catching seducers (two dentists and a doctor among them), as well as abortionists, and them, too, we lodge in the penitentiary.

These drastic, necessarily dramatic, public measures are all, to whatever extent they may be successful, merely the preliminaries to the real, honest, substantial, and steady work of attacking and transforming the untrained public sentiment; of bringing all classes, especially the rich, to a realizing sense of their obligations as stewards of life's opportunity, and of the fact that we are all fellow members of, and brothers in, one corporate being. We are proceeding aggressively in arousing all of our churches to recognize and measure up to their heretofore neglected responsibility to the public at large, to the poor and to the rich, in seeking to create a high moral sentiment. Only when the church does this will she become that perennial fountain of moral energy which is her birthright. I believe, and I think the social workers at large are at last ready to declare, that if the church fails here in her duty, then nothing can be done. The church can do it, she must do it, and, so far as in me lies, I say she shall do it.

To accomplish these high purposes, an aggressive central body must be formed in every community; a morals vigilance society whose work will be to stimulate the life in the associated branches, whatever their names, scattered throughout the community; a society ready to cooperate with the lesser groups, and ready to bear the brunt of the harder court work of employing detectives, of securing evidence, and of getting convictions.

We are fortunate, indeed, in Baltimore, in having the splendid legal talent of Mr. Samuel E. Pentz, who, regardless of other emoluments and professional honors, has dedicated his life to this great public service, this high calling. Mr. Pentz has invariably included the saloon question in the field of our aggressive activities, and in one year has supervised 1,490 applications for saloons, clubs, and like places, protesting between 400 and 500, and furnishing testimony in about 60 per cent of these. In cases where there has been a mixed saloon (colored and white), and the congregating of men and women, applications have generally been refused. Licenses have also been kept from getting into the hands of questionable applicants. Let me say that no one can fight this question without fighting the saloon.

The appeal to the churches of our land, and, indeed, to the people at large, ought to be an easy one. We are professedly a Christian country; all the principles of reform we are now trying to carry out were evidently laid down by our Lord Jesus Christ; while in His own life the use of His power to relieve the suffering and to comfort the sorrowing was a daily exemplification of the fulfillment of the obligation of man to man.

If our churches will do their manifest duty and carry His social message to the poor, blending religion with social service, then the task of purifying our city will be an easy one. If our churches and our people want a clean city, nothing is easier; if they do not want it, it can not be done. Let the professing Christian world remember that one of the principles of judgment of the latter-day world will be: "I was sick, and in prison, and ye visited me not."

Starting from January, 1912, I present the following brief summary of some of the various cases in which the Viligance Society of Baltimore has been the aggressor, under the presidency of Mr. Eugene Levering, and with the cooperation of Dr. O. E. Janney and others:

Forty cases of selling liquor on Sunday.
Twenty-one cases of selling liquor to minors.
Five cases of assault with intent to commit rape.
Twenty-one cases of rape.
Sixteen cases of bawdy houses.
Six cases of bastardy.
Four cases transferred from one State to another for immoral purposes.
Ten cases of pandering.
Two cases of bigamy.
Twelve cases of carnal knowledge.
Eleven cases of enticing minors for immoral purposes.
Six cases of professional abortionists.
Seventy-seven cases of renting houses for immoral purposes.
One case of adultery.

The victims in these cases have, as far as possible, been looked after by us. As the fall term of court has just started, a large number of cases are still open on the docket. There are numerous cases of carnal knowledge yet to be tried, as well as many cases of rape. We have already sent to the present grand jury a list of all houses on Josephine and Watson[1] Streets (red-light district), asking that indictments be returned against the owners renting them for immoral purposes, as was done on Rogers Avenue, where we closed the houses.

We recently sent one of our men with an officer to a number of houses where "sitters" were used, and secured the telephone lists of the girls they called. As a result the police marshal ordered the telephones out of all bawdy houses. Upon complaint that prostitutes were migrating into the city, the marshal of police issued an order preventing the importation of any girls into Baltimore houses of ill fame. A number of arrivals were shipped out about 10 days ago.

We have assumed our share of the responsibility for the conditions in Brooklyn, a suburb of Baltimore, and have secured evidence which we will send to the present grand jury at Annapolis, with the names of a number of the violators of the liquor laws here and in other resorts.

We have a number of abortionists now under close surveillance. We are watching certain manufacturing establishments where we hear that girls under age are meeting the boys at lunch and after the day's work. Some of the department stores are also under inspection. All these sources of evil are being eradicated slowly but effectively. I can not here cite numerous individual cases we are dealing with. We are also watching the so-called hotel and the saloon with private dining room.

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[1] This street and Mince Alley are now closed.

This brief summary gives a general idea of the large scope of our activities this year.

It is my custom to insist that work such as we are now doing, kept continually before the public by our sympathetic press, forms a most valuable educational lesson to the community at large, and has already produced a profound impression.

Fundamental in this great work is the splendid stand taken by Judge Thomas Ireland Elliott, of our criminal court, who has laid down the law and insisted upon its strict observance in rendering the following decision, the basis of our subsequent court activities against all lessors of properties for immoral purposes:

State of Maryland *v.* Meyer Smith, Jacob Rubin, Rosa Nachloss, Edward Gilley.
In the Criminal Court of Baltimore, Part I. Baltimore, Md., May 27, 1912.

Judge Elliott, addressing the defense, said:

"Now, gentlemen, you have been indicted by the grand jury and are now before this court because you have violated the law in leasing for purposes of prostitution certain houses which are owned by you.

"This offense, for which you have been indicted, has always been an offense, in that it has been against the law to do what you have been doing. It has not been, however, usual to indict people for a matter of this kind, and this court is fully aware of the fact that any man could have believed, even if he knew that it was contrary to law, any man could have reasonably understood and believed that the law was winking at the offense and was not visiting any punishment for it.

"I am not undertaking to make any fine legal distinctions. If I were, I should say that no man is ever justified in violating the law, whatever may be his opinion with regard to the expectation of punishment or an apprehension on his part that no punishment will be meted out to him; but I can not find it in my heart to very seriously punish men who have been guilty under these circumstances.

"I think the law, like everything else—like everybody else—ought to give you a chance to stop this thing and to go out of business. Anybody that stays in the business after to-day, after a reasonable opportunity is afforded to get out of the business, can not expect any mercy from this court.

"I am going to be merciful rather than strict this time, and I am going to fine each one of you $5 and costs; and I am going to give you an opportunity to get rid of your tenants.

"If you keep those tenants, and are indicted again and come before me, I will give you the full penalty of the law."

So easy is it for a high-minded judge, if he be sure of the honest and earnest intent and the abiding purpose of the aggressive party bringing the action to clarify and to set a great question on its right basis in a few minutes of time.

I trust that my message is a plain one. I have tried to make it clear that the conditions which surround us on all sides are well known; that the causes of these conditions are also well known; therefore I insist that, from now on, except as we may seek to disseminate this knowledge and to arouse the uninformed in new localities, we need less talking and far more acting, both individually and collectively. I would hark back with you all to my old class motto of '77, which was, "Not by word, but by deed." I am sometimes haunted with a suspicion that we even talk so much in order to postpone acting. If we keep on talking without any corresponding aggressive action we soon fritter away our strength and evaporate our moral force; and then, by every iteration, these monstrous evils will grow familiar to eye and to ear. Next we find them saddled upon us and driving in a mad course downward into the abyss of national decadence, into that charnel house where lie Assyria, Egypt, Greece, and old Rome; where the sentence is the saddest words that can fall on human ears, "Ephraim is joined to his idols; let him alone."

Let those whose interest is quickened hear my words: This is indeed a great work, but to him who plans to take it up for a year or two to clean up his city or to him who simply lends his name to a committee I cry, "Hands off." This is sacred ground; a life work demanding all your energies. This, and nothing less, will clean up your city. Let the pessimist abide at home, for we have no place for him in our ranks.

Slavery is abolished, though it existed through the ages (Jane Addams). The Panama Canal is dug, though it was so infested with deadly miasms as to make it "an impossible task" (Virginia Brooks). Surgical infections are conquered, although they have reigned supreme through the ages (N. A. Powell). So, too, prostitution will go, and in the place of the prostitute we behold with prophetic vision pure-minded mothers of happy families, loving and loved by their husbands; and, as they look from their homes, may they see fulfilled the inspired picture when "the streets of the city shall be full of boys and girls playing in the streets thereof."

SURGICAL STERILIZATION AS A EUGENIC MEASURE.

Bleecker van Wagenen, South Orange, N. J.

The eugenics section of the American Breeders' Association, at its annual meeting last year, appointed a committee of its members to study and report upon practical methods of eliminating defective germ plasm from the human population. The committee consists of Bleecker Van Wagenen, chairman, New York City; W. H. Carmalt, M. D., New Haven, Conn.; Everett Flood, M. D., Palmer, Mass.; H. W. Mitchell, M. D., Warren, Pa.; H. H. Laughlin, secretary, Cold Spring Harbor, N. Y.

The committee has associated with itself, in a consultative and advisory capacity, the following specialists: Medicine, Dr. L. F. Barker, Johns Hopkins University; surgery, Dr. Alexis Carrel, Rockefeller Institute, New York City; physiology, Prof. W. B. Cannon, Harvard University; biology, Prof. H. J. Webber, Cornell University; psychology, Dr. H. H. Goddard, Vineland Training School, N. J.; psychiatry, Dr. Stewart Paton, Princeton University; thremmatology, Prof. Raymond Pearl, Maine Agricultural College; anthropology, Prof. A. F. Chamberlain, Clark University; criminology, Judge W. W. Foster, Court of General Session, New York; sociology, Prof. F. H. Giddings, Columbia University; political economy, Prof. James A. Field, University of Chicago; law, Hon. James M. Beck and Mr. Louis Marshall, of the New York Bar Association; history, Dr. James J. Walsh, dean of Fordham Medical College, New York; statistics, O. P. Austin, Esq., Chief of the Bureau of Statistics, Washington, D. C.; public affairs, Prof. Irving Fisher, Yale University; immigration, Prof. R. De C. Ward, Harvard University; woman's viewpoint, Mrs. Caroline B. Alexander, Hoboken, N. J.

The committee is seeking and receiving assistance from many sources, both public and private, in contributions of data pertinent to its investigations, and it seeks the cooperation of any one having such to impart.

What I have to report is the work of this committee, chiefly personally of its efficient secretary.

NATURE OF THE PROBLEM AND REASONS FOR THE INVESTIGATION.

In recent years society has become aroused to the fact that the number of individuals within its defective classes has rapidly increased, both absolutely and in proportion to the entire population; that eleemosynary expenditure is growing yearly; that some normal strains are becoming contaminated with antisocial and defective traits; and that the shame, the moral retardation, and the economic burden of the presence of such individuals are more keenly felt than ever before. Within the last three years especially there has been a marked development of public interest in this matter. The word "eugenics" has for the first time become known to thousands of intelligent people who now seek to understand its full significance and application.

Biologists tell us that, whether of wholly defective inheritance or because of an insurmountable tendency toward defect, which is innate, members of the following classes must generally be considered as socially unfit, and their supply should if possible be eliminated from the human stock if we would maintain or raise the level of quality essential to the progress of the Nation and our race:

1. The feeble-minded: Using the term generically.
2. The pauper class: Pauper families through successive generations.
3. The criminaloids: Persons born with marked criminal tendencies.
4. Epileptics.
5. The insane (excepting certain forms of acute insanity showing no hereditary taint).
6. The constitutionally weak, or asthenic class.
7. Those predisposed to specific diseases or the diathetic class.
8. The congenitally deformed.
9. Those having defective sense organs, such as the deaf mutes, the deaf and the blind, or the kakaisthetic class.

This is the classification proposed from the social point of view. Obviously it is also partly medical, partly legal, and in part biological. A purely biological classification would be very complex and, in the present state of scientific knowledge, probably impossible, for it must be based upon unit traits of defective inheritance inherent in germ plasm, and their combinations, which result in definite types of defective beings. Only a few of these unit traits have as yet been certainly identified. In the classification above given, it is clear that many of the classes overlap. For instance, factors of feeble-mindedness doubtless run through many of these classes. Insanity and criminality often overlap, and so on through the list. No two individuals belonging to the same general group will have exactly the same combination of traits, and one individual may belong to one only or to several types of the socially unadapted; nevertheless, this classification is the one that best fits into the social scheme, and is the basis upon which society, with the aid of the several social and biological sciences, can well proceed to the investigation of possible measures for eliminating its defectives (Laughlin).

With the statistics at present available, it is impossible to give an accurate statement of the numbers within each of these classes in the United States. From studies of such figures as can be obtained from public and private sources, using the figures of the eleventh, twelfth, and thirteenth United States special censuses as a basis, it seems safe to conclude that nearly 1 per cent of the total population is under custodial care and control in institutions all the time. This is a shifting and constantly changing population, so that many more than that number in the aggregate are inmates of institutions in the course of any one year. Outside of institutions, it seems conservative to estimate from 3½ to 4 per cent equally defective persons not under custodial care, while upon the border line, just above this class, there are probably several millions (perhaps four to five millions) or, say, 5 per cent more who are barely able to maintain themselves, or who just succeed in abstaining from acts which would bring them into the custody of the State. These are the people of inferior blood, who are so interwoven in kinship with those still more defective that they are wholly unfitted to become the parents of useful and valuable citizens. They carry germ plasm more or less charged with defects, and unless their matings are with better strains deterioration is sure to follow in their family lines. Thus we conclude that approximately 10 per cent of our population, primarily through inherent defect and weakness, are an economic and moral burden on the 90 per cent, and a constant source of danger to the national and racial life. It is impossible to measure the industrial and social handicap caused by these individuals. But just as the leaders of successful human endeavor exert an influence altogether incommensurate with their number, so this class, doubtless, constitutes a drag on society of similar magnitude.

PROPOSED REMEDIES.

Along with penal, hospital, and eleemosynary care, a remedy for these conditions is being sought on every side. Among others, the following have been proposed as fitted to promote the desired end:

1. Life segregation (or segregation during the reproductive period).
2. Sterilization.
3. Restrictive marriage laws and customs.
4. Eugenic education of the public and of prospective marriage mates.
5. Systems of matings purporting to remove defective traits.
6. General environmental betterment.
7. Polygamy.
8. Euthanasia.
9. Neo-Malthusian doctrine, or artificial interference to prevent conception.
10. Laissez-faire.

Which of these remedies shall be applied? Shall one, two, or several be made to operate? What are the limitations and possibilities of each remedy? Shall one class of the socially unfit be treated with one remedy and another with a different one? Shall the specifically selected remedy be applied to the class or to the individual? What are the principles and limits of compromise between conservation and elimination in cases of individuals bearing a germ plasm with a mixture of the determiners for both defective and sterling traits? What are the criteria for the identification of individuals bearing defective germ plasm? What can be hoped from the application of some definite elimination program? What practical difficulties stand in the way? How can they be overcome? These and other questions arise, hence this investigation.

For the present we have selected the second-named proposition (sterilization) for our study, as being the one about which little is generally known, both in practice and effects, and which is yet being actively urged for immediate authorizing legislation and practice.

LAWS.

Already eight States have laws which authorize or require surgical sterilization of certain classes of defectives and degenerates—Indiana, Connecticut, Washington, California, Iowa, Nevada, New Jersey, and New York. The first (Indiana) enacted these laws in 1907; the last (New York) in 1912. The types of persons upon whom these operations may be performed, as prescribed in the various statutes, vary as follows:

1. Confirmed criminals or those having confirmed criminal tendencies are named in all the laws. In 5 rapists are specifically mentioned.
2. Idiots, imbeciles, feeble-minded, in 6.
3. Insane, in 4.
4. Epileptics, in 2.

In Iowa habitual drunkards, drug fiends, syphilitics, and certain prostitutes and procurers are included. In New Jersey and New York the words "and other defectives" are added. In Connecticut and California the inmates of certain specified State institutions are those prescribed. In all the laws the question of determination of the individual to be operated upon is committed to a commission or board. In New York and New Jersey provision is made for a review of the commissioner's decisions by a county court or the supreme court, with appointment by the court of counsel to represent the person affected at a hearing.

New York, New Jersey, Indiana, and California leave the character of the operation to be determined by the board or commission.

Connecticut prescribes vasectomy and ophorectomy.

Iowa prescribes vasectomy and salpingectomy.

Washington and Nevada specifically prohibit castration.

Except in Indiana and in California, little or nothing has been done to carry out these laws. Their constitutionality is in question. Attorneys general for the several States do not seem anxious to defend suits, and appear to encourage delay in putting the laws into operation; and in Indiana, where for seven or eight years vasectomy was practiced without law and exclusively at the request or with the consent of the person operated upon, and for two years thereafter, under the law of 1907, compulsorily; there have been no operations since 1909, except a very few cases at their own request, not 10 in all.

In New Jersey a suit is pending in the supreme court to determine the right of the State to have sterilized certain confirmed criminals, insane, epileptics, and feeble-minded persons who have been certified by the State commission as proper subjects for the operation. As the entering of a suit stays the execution of the law, it seems likely that these cases may not be pressed for trial for some time.

In the State of Washington a test case has recently been made, and the supreme court has just decided that the law is constitutional. In this State and in Nevada sterilization is specifically prescribed as a penalty in addition to prison sentence. The court held that the operation of vasectomy was neither cruel nor inhuman, and therefore justifiable as a penalty for certain crimes.

METHODS OF SURGICAL STERILIZATION.

In the male, castration, or removal of the testicles; vasectomy, or excision of a portion of the vas deferens.

In the female, ovariotomy, or removal of the ovaries; salpingectomy, or excision of a small portion or the whole of the Fallopian tubes.

Vasectomy and salpingectomy are the simpler methods, and those generally adopted, unless a diseased condition requires the removal of the organs.

EFFECTS OF STERILIZATION.

Many thousands of operations for sterilization have been performed by surgeons in both private and institutional practice. As a rule, these operations have been for purely pathological reasons, and it has been found difficult to obtain authentic records of their more remote effects. As a matter of fact, records of the effects of such operations extending over a long period of time do not exist to any extent. As a rule, when a patient has made a satisfactory recovery the case is dismissed and the surgeon has no further knowledge of it. The committee has, however, begun the collection of first-hand records of cases of sterilization by different methods, on different types of people, at different ages, and in different conditions.

It has obtained authentic case histories of surgically sterilized individuals of the following classes: The insane, epileptic, feebleminded; criminal (it must be remembered that this class is often also feeble-minded, insane, or epileptic), and persons of normal minds, both male and female. In most of these classes the number of records is yet too few to afford a proper basis for general deductions. The largest number in one class is about 40, male criminals, chiefly inmates of the Indiana State Reformatory. Many of these individuals were also of defective mentality and bad inheritance. Two members of the committee visited the Indiana State Reformatory, and witnessed three vasectomy operations by Dr. H. C. Sharp, surgeon at the institution. More than a dozen previously sterilized men were privately examined by the committee with a view to determining their physical, mental, and moral make-up, with especial reference to the effects of vasectomy on the sexually perverted instincts and practices, and a trained investigator was left in charge to complete the case history records and to study the family histories of the vasectomized men in their home territories. The total number of operations in the institution by Dr. Sharp, so far as records show, was about 300, of which 176 were prior to the enactment of the law, invariably at the request of the men operated on. The other 125 cases were compulsory under the law, and were in the years 1907 and 1908, since which time the practice has been discontinued, except for a very few cases operated on at the request of the prisoner himself. As there is not time to give full data, I will read one or two fairly typical histories in each of the classes before mentioned, and will begin with one of the young criminals in the Indiana Reformatory:

B. W. is of Dutch-American descent; born in the United States; aged 24 at the date of operation, which was performed in the Jeffersonville (Ind.) Reformatory in 1906 at his own request after hearing the subject discussed by two officers of the institution. Wished to decrease his sexual desires, which were constant and excessive; also to avoid the possibility of having children. He was a sexual pervert of a pronounced type and realized (he said) his bad heredity, and did not wish his kind perpetuated. He had been a criminal from his earliest days, and much of his life had been spent in institutions. No education except as obtained there. Of slow intelligence. He claimed (1912) to have improved in mind and body after vasectomy, to have gained in weight, in strength, and in power to concentrate. Sleeps better, less nervous, decrease of oversexuality. Still sexually perverted, however, as shown by his conduct in prison now.

C. R. is of English-Irish descent, American born; aged 28 when operated on in January, 1908, against his wishes, in the Indiana Reformatory. His family was fairly well to do, and there is no reported history of criminal ancestry. The boy early left home, and has apparently an unconquerable "wanderlust," which brought him into trouble in other ways. Was convicted of grand larceny. After the operation his weight increased some 40 pounds. His muscular and mental strength, he says, decreased, but his general health was better, specifically of the kidneys. He asserts that no change in sexual desires or habits resulted. He is now somewhat reconciled in regard to the operation, but thinks that in some indefinite way it harmed his health. There is no evidence of this, however.

These two cases fairly illustrate the majority of those operated on in the reformatory. Dr. H. C. Sharp, who performed each of these operations, was the pioneer in this line in this country. He claims that primarily it was done for the benefit of the individual, and he believes that in nearly every case it did have a distinctly beneficial effect on body and mind, whatever may be the expressed opinion of the individual himself.

The next two cases were insane persons:

M. H. came to this country from Ireland some 10 years ago. Had been in an insane asylum there, 15 years before, for 18 months. Married, shortly after coming here, a woman of low grade mentally, probably feeble-minded, but fond of her children, and keeping them and her house fairly clean and orderly. He was of good habits and a steady worker, earning about $10 a week. There have been eight children, the first born before marriage, and one miscarriage. At the time of the onset of this psychosis, which was allied to the manic-depressive type, twins were born. Three of the children are feeble-minded; three died in infancy; one at 3 years of age. One child of 5 years may be normal, but it is too early to determine. After a few months' treatment it was found that the patient had apparently recovered and was able to go back to the industrial world, and it was learned that he could secure his old position at $10 a week. Meanwhile the patient was a State expense and his family dependent upon charity. The only objection to his release was the danger of his propagating more children of the sort already produced. Vasectomy was proposed, but he objected. The wife was brought in, and the patient, the hospital authorities, and the wife held a conference. Vasectomy was finally agreed to by the man and was performed April, 1912, and the patient discharged. No report of after effects has as yet been received, but we shall get one later.

This quite recent case illustrates how institution authorities may promote eugenic ends by sterilizing certain types of defectives without the aid of a specific sterilization law and be entirely within their legal rights as custodians of defectives and degenerates and protectors of society:

H. P. is a female patient in the State Hospital for the Insane, of California, 22 years of age and single. The operation of double salpingectomy, or laparotomy, was performed on her in August, 1911, against her wishes, but with the consent of guardians. Complete recovery in a few days reported. Ten months later patient said she felt weaker than before operation. Attributed by the physician to unusually hard work in the laundry. Mentally she was more composed and tractable. Before operation had much edema of feet, which condition improved; also, frequent dysmenorrhea, since markedly less.

The next is the case of a high-grade, feeble-minded, epileptic girl, 23 years of age. The operation (salpingectomy) was performed at request of her parents to overcome, if possible, excessive masturbation, to which they attributed the epileptic seizures which began when she was 7. Menstrual periods had been irregular and scant, and her physical condition was poor. Convalescence was satisfactory. Mentally she became more contented and cheerful. Physically generally improved. Menses more regular and normal; gained in weight and strength. So far as can be ascertained, the bad habit is no longer practiced.

Another case is of an epileptic young woman of 23, erotic and sexually uncontrolled. She had induced several abortions, and there was considerable prolapsus of the uterus. She readily consented to the operation. Both tubes were severed and sewed to the outer wall of the uterus, which, with the ovaries, was replaced in normal position. Since then the patient's general health has improved. Epileptic seizures reduced from one every two or three weeks to one every three or four months. In this case subsequent sexual characteristics are not reported.

H. W. L., now 32 years old, is a private patient in a Massachusetts State hospital for the feeble-minded and epileptic. He has been subject to epileptic seizures since early childhood. No alcoholism, epilepsy, or feeble-mindedness found in his family history. Was the second child of parents, 25 and 22 years old, respectively, who subsequently had five more children, understood to be all normal. Epilepsy was attributed to lancing of the gums at 6 months old, which brought on convulsions. Became a persistent masturbator, and during adolescence had occasional irregular sexual intercourse and frequent night losses. At 18 was castrated. He had by this time mentally deteriorated considerably and appeared feeble-minded, his mental condition being that of a child of 12. Since then night ejaculations, which had become excessive, no longer occur, though he states that he still has priapisms. His general health has not materially changed, and his convulsions have continued with about the same frequency as before the operation.

From one institution for the feeble-minded we have reports of seven boys who were castrated on account of excessive masturbation and for eugenic reasons. Their ages ranged from 8 to 31 years. Results varied, but in only one case was there any marked change physically or mentally. In that case there was distinct quieting down, more tractability and good humor. In one case, it is stated, masturbation was continued occasionally, and one, a high-grade boy (30 years old), subsequently ran away and got married.

Of operations on persons of normal minds and not criminals we have records of a considerable number, mostly women. All these operations were for pathologic reasons, and it is not, perhaps, worth while to give specific cases here. Instead, we will sum up as best we may with the material at hand. This is a preliminary report. We have touched in a desultory way upon only a few of the many aspects of our subject worthy of consideration; and, while we do not feel justified in offering conclusions based upon the data so far accumulated, we may say tentatively that such as we have seem to indicate:

First. That the sterilization of the adult male by vasectomy is a simple, practical method of preventing procreation by him without otherwise interfering with his sexual functions; but that it is not certainly permanent in this respect. Castration only is sure.

Second. That sterilization of the adult female by either salpingectomy (ligating or excising), ovariotomy, or hysterectomy, or all three is never wholly free from danger to life or to disturbance of other bodily and mental functions. Modern aseptic surgery and hospital care have greatly reduced these dangers; but they still exist to some extent.

Third. That sterilization of adults by any of these processes does not appear greatly to modify previous sex characteristics and habits. In females, sexual passion is said to be sometimes increased. In males it is more often somewhat mitigated, especially as a result of castration.

Fourth. That there is little probability that sexual immorality would be encouraged or increased as a result of the sterilization of those manifestly unfit for parenthood. Our investigations indicate that such persons are seldom deterred from immoral practices by any consideration which sterilizing would remove.

Fifth. That our knowledge is as yet so limited that only a few types could safely be designated at the present time as suitable for compulsory sterilization. Individuals of these types would have to be carefully selected by competent authority and they would still generally require more or less custodial care throughout life, whether sterilized or not, but their sterilization would be a valuable insurance against unworthy progeny, and so eugenically of value.

Sixth. That vasectomy may become a eugenic measure of considerable value if practiced under the general protection of law, but by persuasion and with the consent of the individual (or his guardians) who is unfitted for parenthood, instead of by compulsion. That this consent can often be obtained when conditions warrant it has been clearly shown.

Seventh. That the sterilization laws already enacted in the United States will have to undergo vigorous attacks before the highest courts before many more compulsory operations are performed, with the probability that there will eventually be material modifications of them.

SEX EDUCATION.

MAURICE A. BIGELOW, Professor of Biology, Teachers College, Columbia University, New York City.

For many years most papers or addresses dealing with sex education have been prefaced by a mass of startling facts regarding the social evil and its associated diseases, presented as an impressive argument designed to awaken intelligent people to the need of organized warfare against sexual disharmonies. The result of such emphasis has been astounding, for to-day the whole intelligent world seems aware of the seriousness of the problems which unhygienic and unethical exercise of sexual functions has introduced into human life. The convincing facts from scientific sources are being heralded by widely circulated books and pamphlets, by popular as well as by scientific journals, by lectures before groups of educators, parents, ministers, physicians, and young people, and by widespread informal discussions. With such extensive dissemination of the facts, it seems scarcely credible that there can possibly be many wide-awake and intelligent citizens in America to-day whose attention has not been called to the existence of some extremely serious sex problems. Moreover, it appears to be generally accepted by all well-informed people that at the root of many of the sexual problems of this age is dense ignorance, and that therefore we must look to education for at least one hopeful line of attack. So commonly accepted is this view that sex education is now needed that I shall waste no time in reviewing medical and social facts that point to the need of scientific instruction concerning reproduction and its attendant problems. On the contrary, I shall assume that sex education in the most extended sense of the term, including both formal instruction in schools and informal teaching in homes, is no longer a highly theoretical proposition, but that it has been demonstrated to be an essential part of the learning process by which young humans are prepared for the most efficient life. Moreover, I shall assume that, as in the case of the three R's of the elementary schools, the educator in home and school need no longer inquire why children should be instructed, but rather how and when they may learn to the greatest advantage. In short, my discussion of sex education will deal chiefly with the subject matter that should be taught and the scientific methods for its teaching in schools and colleges.

Since the social evil and its concomitant diseases have led to an awakening and recognition that sex education of young people is necessary, it is not surprising that so many writers and speakers on the subject have given us a very strong impression that the great central and all-important aim of the movement is to eradicate social diseases. Even prostitution is most violently attacked by some authors because of its attendant unhygienic conditions. And occasionally one finds an author who seems to go so far in the emphasis upon social disease that he advocates teaching children some facts of personal sex hygiene, not for the direct purpose of maintaining individual health, but with the hope that avoiding unhygienic habits in youth will guard against post-adolescent contact with the social evil and its diseases.

Thus in close relation to the social diseases has the sex-education movement progressed from its beginning to the present. Whether this is a sound and permanent basis for sex education is a question which we should frankly face.

Now, without in the least discounting the vast importance of the emphasis placed on the social diseases in the splendid pioneer work of awakening physicians, educators, and the intelligent public in general, from the age-long indifference or ignorance regarding the nature, causes, and effects of the social diseases, and without suggesting any reduction of emphasis in the present educational attack on these diseases, I believe that, so far as formal education in schools and colleges is concerned, we may make a decided advance if we recognize clearly that the social evil and its diseases constitute only one of several very important groups of sex problems that education should attempt to help solve. Concerning these other problems that sex education should touch, my personal view is that knowledge (1) of the facts relating to individual sexual health, independent of venereal diseases; (2) of the biological truths which lead to serious and respectful mental attitude on all sex problems; (3) of hygienic, ethical, and psychical laws which promote physical and mental health in monogamic marriage; and (4) of the established principles of heredity and eugenics which foretell the possible coming of a better race of humans; that knowledge in these four lines represents educational problems of present and future greater significance to human health and happiness than do the social diseases, commandingly important though these be. Therefore, in viewing the field of science with reference to the possible usefulness of its knowledge in helping individuals solve the vital problems that naturally grow out of the reproductive function, I believe that we are logical only when we organize our educational aims so as to give scientific instruction concerning the problems of sex in several lines in addition to the hygienic aspects of the social diseases. As I now see the sex problems which scientific education may help in solving, I am led to classify the educational aims under four general headings as follows:

I. First and most important, sex education should aim to develop an open-minded, serious, scientific, and respectful attitude toward the problems of human life which relate to sex and reproduction.

II. Second, sex education should aim to give that personal hygiene of the sex organs which is of direct value in making for the most healthful and efficient life of the individual.

III. Third, sex education should aim to develop personal responsibility regarding the social, ethical, psychical, and eugenic aspects of sex as affecting the individual life in its relation to other individuals of the present and future generations; in short, the problems of sex instincts and actions in relation to society.

IV. Fourth, sex education should aim to teach young people during adolescence the hygienic, social, and eugenic facts regarding the two destructive diseases which are chargeable to sexual promiscuity.

For emphasis, let me condense and restate the central points in these aims of sex education: (1) Scientific and respectful attitude of mind on sex questions, (2) personal sexual hygiene, (3) social and ethical and eugenic responsibility for sex actions, (4) social diseases. I have deliberately placed these educational aims in this order, not because the last of them is unimportant, but because I believe that it is the order of greatest permanent importance in the sex-education movement, that it represents the greatest value to the largest number of individuals who may learn the scientific truth, and that it is the order most natural, most logical, and most effective in pedagogical practice with young people.

How are these four educational aims to be realized in practice? In preliminary answer we must recognize: (1) Sex education must not be a monopoly of schools and colleges, but the home, the church, young people's associations (such as the Young Men's Christian Association and the Young Women's Christian Association and the Boy Scouts), printed matter, and the personal guidance of young people by teachers and other adults may some day have a combined influence greater than organized education can possibly offer. (2) Since sex education aims at much more than hygiene, it should not in schools and colleges fall entirely within the field of special hygiene courses. The term "sex hygiene" is convenient in science, but it suggests too limited an outlook for educational purposes. Its present general use is tending to introduce confusion, for the major part of the desirable instruction is not hygiene, although much of it may have hygienic application. The educational atmosphere will be much clarified and greater support by the intelligent public secured if we emphasize the terms "sex instruction" and "sex education" rather than "sex hygiene."

Having thus recognized the importance of sex education outside of schools and that it should be more than hygiene, I must devote the remainder of my limited time to an outline sketch of the teaching of the hygienic phase in schools and colleges.

The problems of sex hygiene, either personal or social, should be approached gradually and unobtrusively by way of the nature study of the elementary schools, the biological courses of the high schools and colleges, and the courses of general hygiene in all these types of educational intsitutions. In all grades of schools below college—and, as far as possible, in colleges—courses or series of lessons or separate lectures should not be announced to the pupils or students as sex hygiene or sex education or by any similar title or given any marked attention which tends to set sex processes distinctly apart from other biological problems of life, for thereby we may give them an overemphasis which may prove harmful to some young people and will certainly not help anyone toward the desirable attitude of mind on sex questions. While we may confidently expect that sex education will be developed in the near future so as to give many, and perhaps most, intelligent people a serious and open-minded outlook on problems of sex, we must not forget that in the very physiological nature of human life there are immutable instincts and tendencies which inevitably will make the scientific study of sex processes and problems something of commanding interest and, at the same time, full of dangerous possibilities such as do not exist in connection with any human life processes other than the reproductive.

Hence I urge that, so far as direct study of human-life history is concerned, we must exercise the greatest caution when, in presenting the biology of sex, we attempt to imitate the methods that have long been successfully applied in the teaching concerning all the systems of organs necessary for individual life. We must work carefully, cautiously, and tactfully in all instruction touching closely the human problems of sex, for the effect upon the students is here all important. Abrupt, tactless, unimpressive teaching will be directly opposed to our first aim for serious, scientific, and respectful attitude of mind.

Thus recognizing the necessity for special attention to the method of approaching sex instruction, and the dangers of abrupt and direct instruction concerning human life in lines hitherto ignored by schools, we are led to the proposition that the study of animals and plant-life histories and reproductive processes in the nature study of the elementary schools and in the biology courses of the high schools and colleges is the only safe and logical approach to the problems involved in human-sex processes. Such nature study and biology is a direct working out of the aim for scientific and respectful attitude of mind concerning sex questions. This is not a theory, for hundreds of competent teachers have already made a very successful beginning at putting the idea into practice.

But the nature study and biology, as they are now best presented in schools, offer only the beginning of an attack on the most vital of sex problems, and they should be expanded or supplemented by information directly applied to human life. However, this desirable additional teaching need not take more than a few short lessons at appropriate places in a modern course of high-school biology. For example, a course which has given a glimpse of mammalian embryology will require very few minutes for applying the facts of development to human life; the nature of social diseases will be quickly grasped by students who have already learned the principles of germ diseases in bacteriology; the importance of personal hygiene of sex organs will appeal strongly to those who have followed the physiological phase of biology to its applications in hygiene of various organs; and the hereditary and eugenic responsibilities of parenthood will be impressive to those who have studied examples of heredity in animals and plants. In short, biology taught as an applied science naturally includes almost all the biological facts which the aims of sex education require, and moreover, it will lay a splendid foundation for the desirable social-ethical teaching.

In the foregoing I have stressed biological nature study and biology as offering the ideal basis for the broadest kind of sex education; but I realize that there are cases where nature study and biology courses can not be held prerequisite to some aspects of sex hygiene that young people should know. However, we should aim to make such cases the exceptions and not the rule. Some good may be accomplished by teaching certain facts of sex hygiene frankly and directly to those who have absolutely no knowledge of nature study and biology; but after watching the reactions of groups of boys who were receiving such information, I have been convinced that even with a limit of one hour for instruction a biological setting is decidedly important, in that it gives an indirect approach.

The organization of the program of studies in some schools and colleges is such that sex education may best come in for special emphasis at the close of a course called general hygiene, or personal hygiene; but this is entirely within the suggestion that sex education should grow out of biological science, for we may doubt whether there is possible an efficient course in hygiene which is not in essence a study of applied biology. In fact, the best general hygiene taught in the public high schools of America to-day is presented not as independent courses but as the culmination of biology interpreted as an applied science.

I have emphasized the importance of biology as a foundation for sex education; but at the same time I fully realize that the problems of sex in human life are more than biological and physical. In truth, the greatest sex problems are quite outside biological science, medicine, and hygiene, and clearly within the domains of psychology, sociology, ethics, and æsthetics. Biology can present adequately the physical aspects of reproduction in its relation to life, and thus can render an important service in laying the foundations of a rational system of instruction, but our educational attack on the sex problems will be incomplete and inadequate until we learn how to extend sex education far beyond the present field of biological science and teach successfully the essential psychical, ethical, and social facts that intricately complicate human sex functions.

However, this inadequacy of the scientific instruction which we are now prepared to offer does not in the least interfere with sex instruction on a biological basis. Instead of being discouraged because biology, even at its best, offers incomplete sex education, we should find stimulation in the fact that it offers the only scientific approach to the greatest questions involved in human life, and therefore the teacher of the science is working at the foundations on which, before many years pass, we may know how to build a satisfactory scheme of sex education. The next and most practicable step now possible in the world-wide movement for sex education is the development of the fullest possibilities of the biological studies that touch the problems of reproduction.

In closing, let me state my confession of faith in sex education. It is certainly only one of several possible lines of attack on the alarming sex problems of our time; in fact, it offers only one approach to the solution of even the hygienic phase of those problems. Nevertheless, it is the most hopeful outlook toward improved sexual morals and health, both physical and psychical, that has been or is likely to be suggested. We shall gain nothing by extravagant claims or hopes as to the effect of sex education. It will not completely solve any one sex problem for all individuals who receive instruction; but it will solve all of the problems of many individuals and help many others. It will not eradicate the social evil and its characteristic diseases, but it will protect many a young man and woman, and so reduce the sum total of evil results. It will not prevent divorce and matrimonial disharmonies; but even now the available biological knowledge will help, and some day the social-ethical problems will be well presented, and then most intelligent men and women will understand the fundamental principles for permanent and harmonious monogamic marriage. And, finally, sex education will not enforce universal sexual morality in conformity with our accepted code, but it will help many individuals through decisive battles with sex instincts.

Such are some of the lines along which extreme claims and hopes for sex education have been and are still being made. There is some truth in each; in fact, there is more than enough to justify the present movement for sex education. To all those who see nothing in the movement because it will not solve all the sex problems which have created a demand for special instruction, we may reply by simply pointing to the fact that general education makes some men better and more efficient citizens, but many, many times it fails to give desirable results. We believe in general education, because it aims to offer all individuals help in preparation for more efficient life, although it succeeds only in part. Likewise, we should stand for the scientific instruction of all young people in matters concerning sex, because it is certain that such knowledge will function completely in many lives and will work appreciable good in many others. Toward such valuable results the outlook is great, for history and geography and many other school subjects may be of little use in the lives of many people, but sex education, like personal hygiene, deals with problems which each normal individual must solve for himself.

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